The

Geographical Journal.

No. 1. JANUARY, 1910. Vol. XXXV.

MESOPOTAMIA: PAST, PRESENT, AND FUTURE.*

By Sir WILLIAM WILLCOCKS, K.C.M.G.

"Out of Eden came a river which watered a garden, and from thence it was parted and became four heads." Plans and levels in hand, starting from the spot where Jewish tradition placed "the gates of Paradise," I have followed the traces of the four rivers of the early chapters of Genesis. Appointed by the new Turkish Government to engage engineers and survey and level the rivers and canals of the Tigris-Euphrates delta, and devise projects for the rehabilitation of the country, I first set myself the task of mastering the ancient systems of irrigation, improving on them when I could, and adopting them when I could find no better substitute. I started with the Garden of Eden.

The Euphrates enters its delta a few miles below Hit, at the gates of Babylonia, where Cyrus the Younger's army, accompanied by the ten thousand, left the deserts and entered the alluvial plains which terminate at the Persian gulf. What the gates of Babylonia were to one descending the Euphrates, the gates of Paradise were to the early livers in the Babylonian plains.

Upstream of Hit, past Anah, the river is to-day a series of very indifferent cataracts, where the current turns giant water-wheels which lift water and irrigate the narrow valley to the edge of the desert. Garden succeeds garden, orchards and date groves lie between fields of cotton, and life and prosperity are before us wherever the water can reach. I do not think it possible to imagine anything more like a practical paradise than the country near Anah. Every tree and crop must have been familiar to Adam except the cotton crop. Though to-day, owing to the degradation of the cataracts, a degradation whose steady progress was noticed by the writers of the Augustan age,

* Read at the Royal Geographical Society, November 15, 1909. Map, p. 104.

water-wheels are necessary to irrigate the gardens; it is easy, indeed, to imagine the condition of the river when the cataracts were such as we see on the Nile, and water could be led off from above a rapid and utilized for irrigating, with free flow, gardens situated a little downstream and above the reach of the highest floods. Such was the Garden of Eden, and its site must have been near an outcrop of hard rock like we see at Anah, where, in coming down the river, we first meet the date palm, which even to-day is a tree of life to the whole Arab world.

Below Hit no place can be found for a garden without lifting apparatus and protective dykes, because otherwise any garden irrigated in the time of low supply would be inundated in flood, and, if irrigated in flood, would be left high and dry in the time of low supply.

Downstream of the garden the river was parted and became four heads. The first was Pison, represented to-day by the many-armed depressions of Habbania and Abu Dibis between Ramadi and Nejef, which are not inaptly described, from the point of view of a dweller in Babylonia, as encompassing the whole land of Havilah which lay between the frontier of Egypt and Assyria.

The second river was Gihon, the modern Hindia, the Chebar of Ezekiel, who lies buried on its banks, the Ahava of Ezra, the Pallacopus of Alexander, and the Nahr Kufa of the early khalifs. It is represented as encompassing the whole land of Kis or Kutha or Cush, the father of Nimrod, the beginning of whose kingdom was Erech and Akkad and Calneh and Babylon. The ancient town of Kutha lay on the Nahr Kutha, which was in all probability the main stream of the Euphrates in the earliest times, and on whose banks were situated Kutha, Nil, Niffur, Erech, and Tel Senkere, which date from days long prior to Babylon, the capital of Khammurabi, founded on the Babylonian branch when the other had silted up.

The third river was Hiddekel, the modern Sakhlawia branch, some 250 feet wide and 25 feet deep to-day, running like a millrace into the wide Akkar Kuf depression, and flowing out of it into the Tigris at Baghdad. If left alone, the Sakhlawia would be capable of carrying more than half the waters of the Euphrates, and rendering the country between the two rivers uncultivable. In ancient times it was undoubtedly a second head to the Tigris, and from the point of view of a dweller in Babylonia, it was accurately described as "that it is that goeth in front of Assyria."

And the fourth river was Euphrates. No definition was necessary. It was the river of Babylon itself.

Just as the Babylonian colonists carried the name of Tigris with them to Nineveh, so doubtless, in times after the most ancient, they gave the name of the river of Babylon to the great stream on whose banks was situated the cradle of the race. From source to mouth one river became the Euphrates, and the other the Tigris.

The Tigris enters its delta at Beled, south of Samarra, over the ruins of one of the most interesting works of antiquity. In ancient days some giant, local tradition says Nimrod, closed the channel of the Tigris by an earthen dam and turned the river over the hard conglomerate, forcing it to flow at a high level and irrigate the whole country. Coursing down over rapids, the Tigris became navigable at Opis; and from there past the modern Baghdad and on to Kut it kept within the channel of to-day. From Kut on to Ur of the Chaldees, past Tel Lo, the ancient Tigris followed the line of the modern Hai or Garraf branch. The country past Amara and Gurna on the modern Tigris was an immense sheet of fresh water known as the Susiana lake. The levels of the country prove this beyond the question of a doubt.

The junction of the Tigris and Euphrates was at Ur of the Chaldees; and from there the joint waters of the two rivers flowed past the modern Zobeir and down the Bubian channel of the Khor Abdalla. The 3-fathom line depicted on the British Admiralty charts clearly shows the ancient mouth of the river north of Koweit. The Khor Abdalla has two heads, one represents the joint waters of the ancient Tigris and Euphrates, and the other the mouth of the ancient Karun.

The Karun river has played no small part in the formation of the Tigris-Euphrates delta. While the Tigris and Euphrates have left all their deposit behind in the Babylonian, Chaldean, and Susiana marshes, the Karun has always hurried down from the Persian hills and carried its silt-laden waters into the Persian gulf or into the joint stream of the two other rivers. It has been the sole factor in forming the comparatively high-lying land which stretches from Basra eastwards. This tongue of land protects the Tigris-Euphrates swamps from the inroads of sea-water, and keeps them fresh. The Basra bar is formed almost entirely of Karun mud. The Tigris and Euphrates mud lies far away to the west.

The ruins of all the more ancient cities lie near the junction of the Euphrates and the ancient Tigris at Ur of the Chaldees. The two rivers had left their deposits in the extensive marshes higher up their course, and the earliest settlers had to do with opaque water, rich in chemical matter, but free of silt, which would have necessitated the presence of many hands to keep their canals clear. A comparatively small population could begin and continue the development of the country, and it was not until the inhabitants became really numerous that the silt-laden waters higher up the rivers were taken in hand.

The lands in the marshes so reclaimed and cultivated became extraordinarily productive, as we see to-day. They were valuable enough to be protected from floods by immense dykes running along the banks of the rivers, which can be followed to-day for miles upon miles, with a width never under 100 feet.

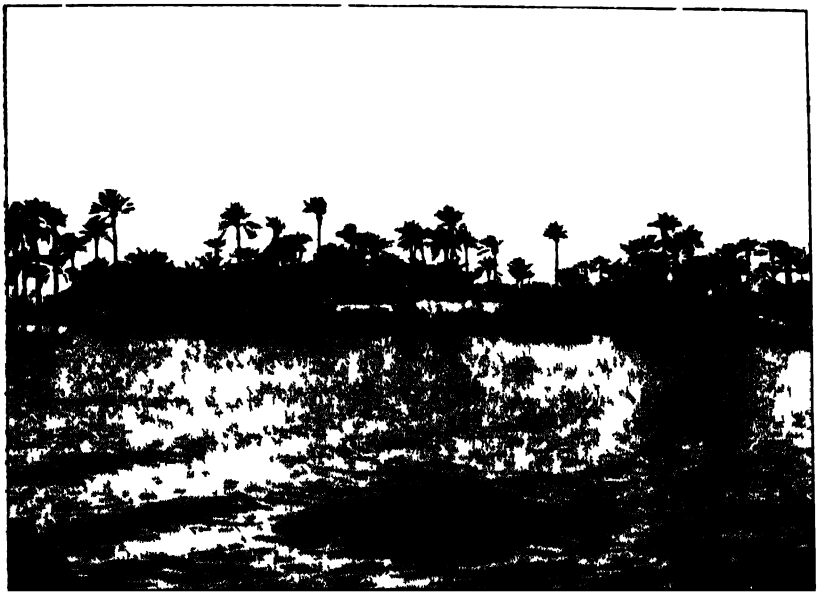
The great value of water free of silt for the early development of the country is the first serious lesson I have learned from an examination

of the ancient systems of irrigation, and you will see later on how we propose to utilize this knowledge.

The Tigris and Euphrates carry in flood during a few days every year over four times as much silt as the Nile. Irrigation with such water will be no easy task even to-day. It was terribly difficult in the old days when they had no cement, and were ignorant of every kind of weir or barrage except an earthen dam completely shutting off the waters and causing convulsions among the people living lower down.

While the development of the country was confined to the low-lying lands blessed with water clear of silt, everything in the delta went on smoothly enough. Pressure of population made the work of development advance into the parts where there was no clear water, and then the difficulties began. In the language of Genesis, the world became full of violence. A strong central government could only have dealt with the question, and there was no strong government. Now the Euphrates and Tigris floods come down with extraordinary force, and both rivers, but especially the Euphrates, overflow their banks in a way a dweller in the Nile valley could have no knowledge of. Joseph's famine would have been impossible in the Tigris-Euphrates delta. Noah's flood would have found no place in Egypt.

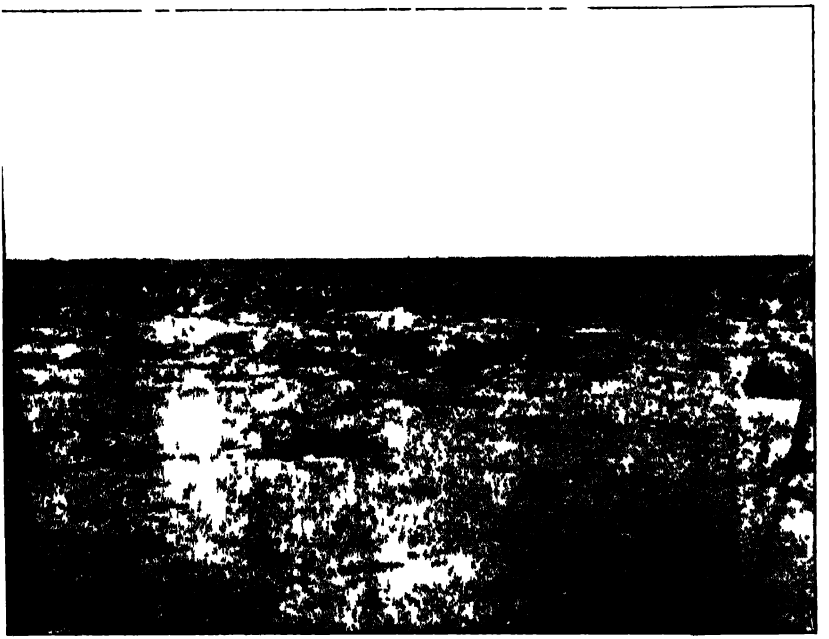
As men crowded up the two rivers, the necessity of protecting themselves from the floods and at the same time keeping their canals free of silt, compelled the early more powerful communities to resort to the only kind of regulation they knew of, and that was the bold one of bodily shutting off the waters of certain of the branches by earthen dams. Judging from the levels, I should say that the first head to be shut off was that of the Hiddekel, or the modern Sakhlawia. Until this was closed nothing could be done with the upper half of the delta. The struggles between the different communities, and the terrible consequences which might result, intimidated the more thoughtful members of the community, of whom Noah was one, and he prepared for the worst. He built an ark of the poplar wood so common in the Euphrates valley, and pitched it inside and out with bitumen from Hib, just as the boats and corracles on the Euphrates are pitched to-day. A settler probably in the lower part of the delta south of Kerbela, where the deserts, moreover, are strangely degraded and low, he felt the full force of the inundation. A massive earthen dyke was thrown across the head of the Sakhlawia, the flood discharge of the Euphrates was doubled, and instead of the waters rising 16 feet, as in an ordinary inundation, they rose 15 cubits, or 24 feet, and not only was the cultivated land under water, but the deserts themselves were submerged. To men living in the Euphrates valley and in the valley of the Nile, the word "jebel" does not represent a hill, but the desert. In the English translation the word "mountain" represents something those people never saw.



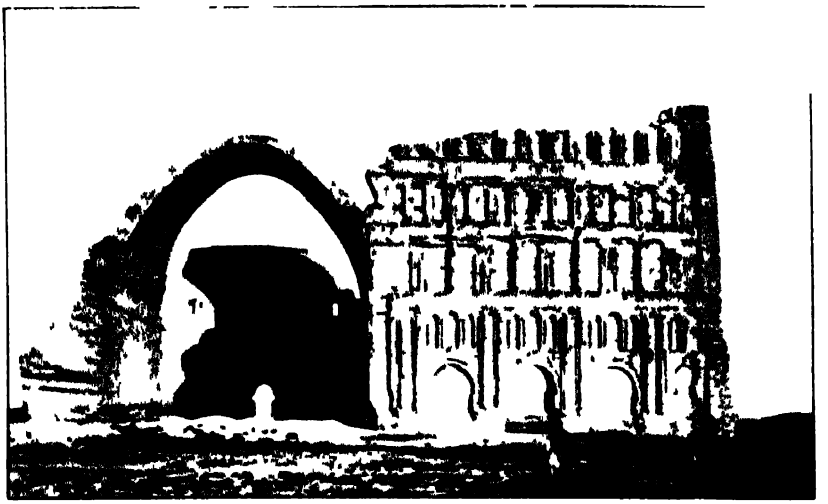
AN ISLAND IN THE EUPHRATES NEAR ANAH



THE WATER RETURNING FROM THE SWAMI TO THE RIVERS



UNBRICATED MESOPOTAMIA



NAUSHERWAN'S PALACE CTESIPHON

In the Arabic translation it is properly called the "jebel." A rise of water of 15 cubits could put no hill, leave alone a mountain, under water.

While travelling in Upper Egypt I have often been asked by the less-informed sheikhs whether England was irrigated by basins or by watercourses. On my replying that England had no irrigation at all, the remark has invariably been, "Then, how do the people live in the 'jebel?'"—pronounced "gebel" in Egypt. As Director-General of land tax adjustment in Egypt, I was once valuing the lands in a large basin, in the middle of which was a small desert mound some 2 acres in extent and 4 feet high; on my suggesting that we might ignore so insignificant a patch of land, I was told that you could not tax the "gebel." Mentioning these facts to Colonel Ramsay, the British resident at Baghdad, and to Mr. Van Ess, the Basra missionary, who were travelling with me, and just then on a steamer in the Nejef marshes, we agreed to test the matter on the Euphrates. Approaching Shinafia, we saw the low degraded desert on the horizon, and asked our boatmen what that was; they immediately replied, "The jebel." It was no more like a hill than Ludgate Hill is like a mountain.

Floating off in all probability from near Kerbela, where one of the shrines of the patriarch very properly stands to-day, and driven by the current and the wind, both steady from the north, the ark drifted southwards and wandered long in the Chaldean marshes. Finally it touched land, probably somewhere near Ur of the Chaldees, on the edge of the desert. I say Ur of the Chaldees, because it is here that we find Terah, the father of Abraham and the representative of the patriarch's family. I think readers of the Bible will agree with me that the representatives of the patriarchal families were a stationary kind of people in place and habits. It was the Cains and Tubalcains who moved about, undertaking new pursuits and making discoveries. The fact that Abraham, the friend of God, should have wished to move made him a marked man, and earned him his name of Hebrew.

Ararat was the name of the desert mound where the ark rested; and when the families of the younger sons of the patriarch moved off and made new settlements, they gave the name of Ararat to the highest mountain they knew, in honour of the spot where the ark rested. This Armenian Ararat could no more have been the Ararat where the ark rested than New York be York.

As I have tried to depict these early events, everything has been looked at from the point of view of the dweller in the Babylonian or Chaldean plain. And this is in accord with the opinion of the time. My friend, the Rev. Prof. Sayce, has shown me a copy of a Chaldean map of Abraham's time, in which the Earth lies round Babylon as a centre.

In following the history of the delta, the second lesson we have learned is the necessity of controlling the floods of the Euphrates if any serious development of the country is to be undertaken.

The dwellers in the Euphrates delta, tired of anarchy and confusion, gladly welcomed any strong man ready to produce order and method in a country which could not exist without order and method; and they found their "mighty one" in the person of Nimrod, according to Genesis, or Khummurabi, according to the tablets. The dwellers in the delta to-day are in the same position. I have seen eight hundred armed peasants, all Arabs, volunteer to help the Government troops to keep order. Every Arab family, like that of Isaac, has some of its sons after the peaceable Jacob and some after the Beduin Esau. In Mesopotamia to-day the would-be agriculturists have little chance, for whenever they desire to settle, down comes a mighty flood and converts them into wanderers. Let the floods be controlled and the irrigation works begin operating, and it will be seen that those on the side of order are more numerous than those against it, and moreover far more earnest.

This dispute between the agriculturists on the one hand and the shepherds on the other is as old as the feud between Cain and Abel. About May 5 this year, when the flood was at its highest, I was riding up the left bank of the Euphrates from Ramadi to Hit, and counted over fifty flocks of sheep of about 200 each, or 10,000 sheep in all, walking into the valley from the desert. The appearance of the shepherds made the agriculturists alert, and on my way down the river in a boat the next day I heard two shots fired quickly one after the other, and in an instant the cultivated plain was covered with men on horseback and on foot rushing to the spot, some with spades and some with guns. They were prepared to fight the Beduin shepherds or the flood. Meeting one of the head sheikhs, I asked him why they could not arrange to let some of the land be inundated and some put under wheat and barley; he said that they could not agree among themselves, but would be pleased to see some order and method instead of the eternal feud. He added that if working rules were laid down, the agriculturists were sufficiently numerous to insist on their being respected.

All the early kings who did anything worth recording have left memorials of the canals they constructed, to which they gave names strangely similar to the "Kanatir il Khairia," or "Bridge of Blessings," which the Egyptians apply to-day to the first barrage constructed on the Nile.

As population increased we hear of reservoirs for storing water for perennial irrigation, especially for the important Arakhtu canal which came down from Sippara and irrigated Babylon.

It is recorded of Cyrus the Great that he too utilized his army for digging numerous canals from the Gyndes or Dyala. Many of these canals are in use to-day.

Herodotus gives a picturesque and glowing description of Babylonia in B.C. 480.

Some fifty years later, Xenophon, as becomes a disciple of Socrates,

gives an exact description of the country as he saw it. Book in hand, I have followed his march in the delta from "the Gates" to Opis, and I here give my impressions. Cyrus the Younger's army entered the delta at the Gates already described, and crossed the valley of the Sakhlawia by the great earthen embankment which from all antiquity stretched from desert to desert and kept the Euphrates within its own valley. Cyrus anticipated the reopening of the branch by Artaxerxes, who had dug a new canal down the valley of the Sakhlawia, trusting to the steep slope to soon scour out an impassable barrier to his brother's army. Hurrying along the dyke, the army of Cyrus entered the desert plateau of 110 square miles in extent which lies between Feluja and Baghdad, and over which Artaxerxes' army advanced under thick desert dust which looked like a white cloud. Xenophon saw the first of the four canals, known in the times of the Khalifs as the Issa, the Sarsar, the Malik, and the Kutha, which leave the Euphrates south of this desert plateau. The first is in very deep digging in the desert. He saw no more, and spoke from hearsay of the rest, for he is wrong in every particular, a circumstance rare with him. Mind, he does not say that he saw them. The canals are not the same size, they are by no means the same distance apart, and they do not run from the Tigris to the Euphrates. In this reach the Euphrates is 25 feet higher than the Tigris. The battle of Cunaxa could not have been fought south of the desert plateau, as the country was intersected by four large canals and countless deep watercourses, and was, moreover, heavily irrigated. Armies accompanied by large bodies of cavalry, chariots, and baggage-waggons could not have moved at all, leave alone manœuvred and fought. After the battle the ten thousand retreated in a north-westerly direction, with the rising sun on their right hand, and were entangled in the watercourses fed by the new canal just dug by Artaxerxes and now opened. North of Tel Safêra there are no dykes or trenches going northwards. The Median wall, I think, stretched from Tel Safêra to Akkar Kûf, and from there to Coche on the Nahr Melcha, opposite Ctesiphon. It protected Babylonia from the Assyrians first, and then from the Medes in the pre-Persian days; it took the place of the Sakhlawia branch, which, as already twice stated, was closed from the earliest times. Artaxerxes opened his canal in August, during the time of low supply, or there would have been a catastrophe.

Keeping south of the Median wall, the ten thousand crossed over to the north at some point west of Akkar Kûf, and, winding their way round the Akkar Kûf depression, crossed two canals, both coming from the Tigris near Nimrod's dam. The latter was the Izhaki canal, on whose east bank was Sitaki, not far from the modern Kazimain. They crossed the Tigris by a bridge of boats with the same number of boats that the Baghdad bridge had a few years ago, before it was replaced by the present one of larger boats. From here they had to leave the river,

as the country was heavily irrigated by the numerous canals, into which Cyrus the Great had led the Dyala. The troops with the transport waggons had to follow the road, which doubtless then, as now, went to Bakuba, and so the distance covered was 50 per cent. in excess of the bee-line which commentators ordinarily measure along. At Opis they crossed the Physcus, or Adhaim river by a bridge 100 feet long, and entered desert country. At Manjur, which Captain Felix Jones, of the Indian navy, unerringly stated to be the site of Opis, the Adhaim river flowed into the ancient Tigris before the river burst into its present channel. Immediately to the north of this point we leave the alluvium of the Tigris, and enter the unirrigable marls which Xenophon called deserts.

Alexander's historians give a vivid description of the irrigation of the country and the difficulty the Babylonians had in closing their canals in flood and clearing them in low supply. They described the closing of the canals in flood as by far the more difficult operation. Alexander entered into the work with all his energy and genius, and to-day we can only admire the judgment with which he treated the Hindia branch or the Pallacopus, and the promptitude with which he acted. The whole of the waters of the two rivers was used for irrigation in all but the flood season, and Alexander had to remove the earthen barrages thrown across the Tigris before his fleet could sail up the river from the sea.

In the time of the Sassanian kings of Persia, in the early centuries of the Christian era, the delta probably saw its greatest prosperity. The gigantic Nahrwan canal, 400 feet wide and 15 feet deep, irrigated all the country to the east of the Tigris, and the Dijail irrigated that to the west. The Euphrates gave off the four canals already mentioned by Xenophon, and canals fed by the Babylonian branch from near Babylon irrigated the country right up to the ancient Tigris, or the modern Hai branch. Ammianus Marcellinus, who traversed the whole length of the delta in the fifth century of our era, describes the country as a forest of verdure from end to end.

The centres of development varied from period to period. While during the earliest times, Tel Lo, Senkere, and Ur of the Chaldees were the heart of the country; Sippara and Babylon took their place in Babylonian times; and Opis and Ctesiphon in that of the Persians.

In the seventh century of our era, the Arabs overthrew the Persian Government, and substituted Kufa, Wasit, and Basra, as capitals in place of the earlier cities. These soon gave place to Baghdad, which till to-day has remained the most important town in the delta. Baghdad saw its greatest days about A.D. 800, in the reign of Haroun-el-Rashid. Under the Arabs, the prosperity of the country steadily declined, but the final blow was given by the Mongols under Zengis Khan and the Tartars under Timur in the thirteenth and fourteenth centuries. Previous disasters had drenched the country in water; it was now



BASRA CREEK
(*Photo by Percy L. Lorraine*)



SOUTH ROAD IN BAGHDAD.



RUINS AT BABYLON



THE GATE OF ISTAR AT BABYLON

drenched in blood. In the anarchy and confusion which ensued, all the great works of antiquity were swept away one after another, until not a single one remains to-day. Nimrod's earthen dam on the Tigris was breached, and the level of the water in the river fell some 25 feet, leaving the great Nahrwan and Dijail canals dry and waterless. Both banks of the Tigris in the upper part of the delta became a desert. The Tigris, lower down its course, fared no better. Near Kut, the river breached its left bank and wasted itself in the marshes on the Persian frontier, while the ancient channel past Wasit and Tel Lo received a limited supply of water only in flood-time. The ancient dyke across the Sakhlawia branch of the Euphrates was breached, and Western Baghdad with its irrigation system was wiped out. All the canals taking water from the Euphrates which had come down from a remote antiquity, the Issa, Sarsar, Melcha, Kutha, Araktu, Surat, Nil, and Nars, silted up and ceased running; and finally in our day the Euphrates of Babylon has dwindled into an insignificant stream, and the whole of the waters of the river are flowing through the Nejef marshes. The Tigris and Euphrates, left to themselves, have deserted the high lands which they irrigated in old days, and are now traversing the lowlands and marshes along the extreme east and west of the delta.

Things would have been far more desperate than they actually are had not a new crop been introduced into the country, which has permitted of large areas of swamp being turned into valuable fields. When rice first appeared in the delta no one can tell, but it is the most valuable crop in the country to-day after the date crop.

The delta of the two rivers has an area of some 12,000,000 acres, of which about 9,000,000 are desert, and 2,500,000 acres freshwater swamp. In the upper parts of the delta there are stretches of cultivation along the river-banks in places, and along a number of small canals; but in the lower part of the delta there are magnificent reaches of date groves and gardens interspersed with clover and cereals, and large areas under rice in flood.

We have seen that the earliest settlers in the delta clustered round the reaches of the rivers where the water was free of silt. It is the same to-day. This water, though free of sand, is opaque in colour, and retains the rich chemical ingredients so necessary for agriculture. It is totally different from the dark-looking, transparent water which has stagnated in the marshes.

The rainfall is on the average about 8 inches per annum. The whole of the rain falls in winter, and there have been years in succession when the total fall has not exceeded 4 inches. Of such tracts, President Roosevelt, in his first message to Congress, has well said, "In the arid region it is water, not land, which measures production." We therefore turn to the amount of water in the two rivers. The Euphrates has a high flood of 120,000 cubic feet per second, and a low supply of 10,000

cubic feet. The corresponding figures for the Tigris are 180,000 and 10,000.

The rivers are in flood in March, April, and May, while August and September are the months of low supply. We may, without the aid of reservoirs, count on 6,000,000 acres of winter crops, and 3,000,000 acres of summer crops. We shall have wheat, barley, and beans in winter, and cotton, Indian corn, and rice in summer. To-day, if the winter rains are above the average, large areas of land are put under barley, for the deserts of Mesopotamia are not deserts like those of Egypt, but in great part steppes capable of supporting millions of sheep. The date palm is at home everywhere in the delta, while the Basra groves are credited with ten million trees. Dates and wheat are considered as growing wild at Anah.

The winter is severe, and the summer is very hot and prolonged. Live stock of every kind is abundant, and of superb quality. Old Mahomed Pasha il Daghistani has two hundred Arab mares in his studs at Azazia, on the Tigris. Live stock will always be one of the principal exports of the country.

The delta is strangely flat. Baghdad, removed some 500 miles from the sea, is only 115 feet above sea-level. Opposite Baghdad the Euphrates is 25 feet higher than the Tigris. Between the two rivers runs a regular valley, across which are carried the giant banks of the ancient canals like miniature hills.

The waters of the two rivers and the soil of the country are yellow in colour, and very different to the black soil of Egypt. The percentage of lime in water and soil is as high as fifteen, and consequently the soil is far more friable than the stiff clay of the Nile valley. The chemical analysis of soil and water testify to their richness.

Beginning at Beled, the delta first consists of bare plains of clay with the silt banks of countless canals, showing what a desperate fight the wretched agriculturists made for existence when the dams were carried away and the level of the water fell. We then have alternate stretches of level country covered with a thorny leguminous plant which dies down in winter, and the same bare plains which we met in the north. Near the rivers are jungles of liquorice plant and the same leguminous thorn. On the rivers themselves, but especially on the Euphrates, wherever there is a foreshore, there is a luxuriant growth of poplars and sometimes of willows. On the upper Euphrates, and as one approaches Babylon, we have great stretches of salted land interspersed with bare plains and low sanddrifts. All this land is capable of easy levelling and reclamation. The presence of 15 per cent. lime in the soil renders reclamation very easy compared with similar work in the dense clays of Egypt. One is never far away from the giant banks of old canals and ruins of ancient towns. As one goes south the salted land increases in area, and then the marshes begin

with their stretches of rice. On the lower Euphrates and on the Basra river are luxuriant date groves and gardens mingled with wheat and clover. The lower Euphrates, past Nasrie and Suk es Shaytk, is a veritable garden surrounded with water.

The junction of the Tigris and Euphrates is no longer at Kurna, where it had been for 500 or 600 years, but at Garmat Ali, near Basra.

Such is Mesopotamia to-day. From what has been already said, it will not be difficult to gather that the first works before the hydraulic engineer are the protection of the country from floods, and the provision of water as free of silt as possible. The levels and surveys of the twelve engineers who are working for me in Baghdad, with a devotion worthy of the task they have undertaken, have shown that we can do both. We have already submitted to the Government a project for escaping the excess waters of the Euphrates down the depressions of the ancient Pison, the first of the four rivers of Genesis. An expenditure of £350,000 should suffice for the work, and it should take three years to carry out. I am under and not over the mark when I say that the cultivated area will be doubled and the yield of wheat trebled along the Euphrates the day this work is completed. The cultivators to-day are afraid to sow anything like the crop they could put in; and, moreover, they count on losing everything every third year. If Noah had been an hydraulic engineer, he would have constructed the Pison river escape instead of an ark, and saved not only his family but his country as well. This escape has been approved of by the Turkish Government, and the necessary funds have been assigned for beginning it immediately. Its effect will be far reaching.

The surveys and levels are now in hand for a project for the great central canal of the delta, which will irrigate 3,000,000 acres of the best land in Mesopotamia, and carry water free of silt. North-west of Baghdad, between the Tigris and the Euphrates, lies a strange depression known as the Akkar Kuf lake. It has an area of 40 square miles at extreme low water, and 300 square miles when full. Its level is 35 feet below that of the Euphrates, and 10 below that of the Tigris. Into this depression runs the Sakhlawia branch of the Euphrates, the ancient Hiddekel, or the third of the rivers of Genesis, with a channel 250 feet wide and 25 feet deep at the head, which splits up into some twenty small channels as it enters the western side of the lake. The head of the Sakhlawia branch will be provided with two powerful regulators to control the supply leaving the Euphrates. On the Euphrates downstream of the branch will be a barrage to control the river itself. These works will ensure our supply from the side of the Euphrates.

On the Tigris, we propose to construct at Beled, near the site of Nimrod's dam, a weir for controlling the river. This work will be above the Tigris rapids, where the water is 60 feet higher than that of Lake Akkar Kuf. From the upstream side of this weir we shall

construct a canal to irrigate the rich lands north of Baghdad, with an escape into the lake. The escape will keep the canal free of silt, and feed the lake with Tigris water. We shall thus have all the water we need from both rivers, entering the lake at its western and northern sides.

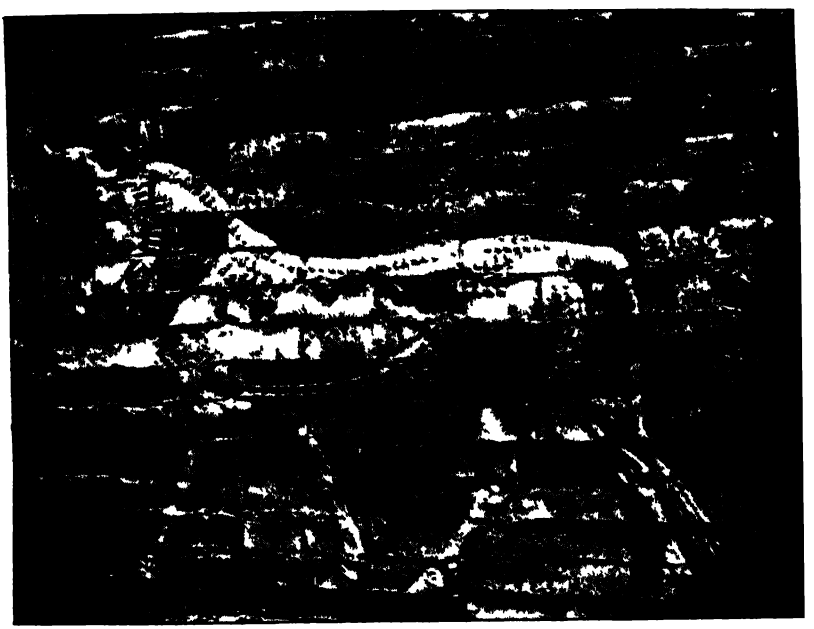
From the south-eastern end of the lake, near Baghdad, will start a canal which will run along the right bank of the Tigris and finally tail into the Hai branch or ancient Tigris near its head. In the days to come, this canal will irrigate 6 million acres, but not now. The excessive silt of some fifteen days per annum, which does all the mischief, will be decanted in the lake, and so will all the silt we do not need. At certain stages of the flood, when the river-water is not heavily charged with silt, it will be possible to take in supplies at different points of the canal. All these details will come later. We are now concerned with broad issues.

The left bank of this canal, which I shall submit to the authorities to be called after the name of the first constitutional sovereign of Turkey, will act as a dyke for protecting the country from the Tigris floods, and will, moreover, carry a railway to transport the abundant harvests of the country. We shall again see Sippara, Kutha, Nil, Niffur, Erech, Tel Senkere, and Tel Lo important centres of life and prosperity.

Dealing with water free of silt, it will not be necessary to complete the whole length of the canal before we can begin sending down our supplies, as we should have had to do with muddy water. We shall first complete some 30 miles, and immediately use the water for irrigation in this reach while we are digging the second reach of 30 miles. In this way we shall waste no time.

The works should, I think, be carried out on the following principles. The Government should undertake the construction and maintenance of the barrages on the rivers, the main feeder canals, the main drains, the navigation works if any, the flood escapes, and the flood embankments. In this way the control of the rivers and their supplies would be in the hands of the authorities. All minor canals, drains, and masonry works of every kind should be left to the agricultural community and to interested parties. In return for constructing and maintaining these works they would receive title-deeds for the lands they irrigated. I had at first thought of recommending the Chenab system of irrigation works, but acquaintance with the people has taught me that all details should be left to the agriculturists themselves. They have their own ideas, and will be far happier working on their own lines, many of which have come down from the remotest antiquity, and are well worthy of preservation.

I have shown how the country can be protected from floods, and how a beginning can be made with the irrigation of 3,000,000 acres of land capable of producing annually 1,000,000 tons of wheat, and 2,000,000



BULL ON THE GATE OF ISTAR AT NEBUCHADNEZZAR'S PALACE AT BABYLON

cwt. of cotton. It now remains to consider how we are going to get this produce to the markets where it will be sold, and how we are going to dispose of the millions of sheep and hundreds of thousands of cattle which the delta will contain.

Every merchant and man of business I have talked with in Baghdad is convinced of one thing, and that is that the backward state of the country is due in great part to the fact that while communication is open by river with the east, it is to the west that the whole produce of the country wants to find a way. In this direction there is no outlet. The principal products of Mesopotamia to-day—sheep, cows, buffaloes, wool, liquorice, wheat, barley, and rice—have their markets in the Eastern Mediterranean and in Europe, and all the imports the country stands in need of could come most readily from Europe. What is wanted, therefore, is a cheap railway connecting Baghdad with the Mediterranean by the shortest and cheapest line possible. Such a railway would have its outlet on the Mediterranean coast near Tyre and Sidon. These centres of commerce did not place themselves by accident where we find them to-day. They fulfilled the requirements of the trade of Western Asia. Haifa and Beirut, to the immediate south and north of Tyre and Sidon, are the modern representatives of these old Phœnician cities. They are connected by railway with Damascus. Very shortly Tripoli, to the north of Beirut, will be connected by railway with Homs, on the Damascus-Aleppo railway.

Any railway going east from Damascus or Homs must pass through Palmyra, founded by Solomon in Israel's great days, and the capital of Zenobia in later times. From Palmyra will diverge the railways of the future, which will either go north to Thapsacus on the Euphrates, another creation of King Solomon, or to Der Zor of the Khalifs, or eastwards to Abu Kimal near Salahia, a creation of Saladin's. The Damascus-Baghdad railway will pass through Palmyra, Abu-Kimal, Hit, and Baghdad. At Abu Kemal the railway will tap the only part of the upper Euphrates valley capable of great development. In the centre of this tract is situated the rising town of Meyadin, on the site of the ancient Rehoboth. At Hit we have the terminus of free navigation on the Euphrates and the future port of the river. Rivers whose waters are used up in irrigation have their ports where they begin to be navigable.

The Euphrates upstream of Hit, up to El Kaim past Anah, has a narrow valley, but the current is sufficiently strong to turn large water-wheels, which irrigate the country up to the edge of the desert. Upstream of Suk-es-Shayûk this is the only tract on either of the rivers which enjoys perennial irrigation without having to lift the water by means of oxen or pumps. For the area cultivated the population is very dense and the crops excellent. We can here form an idea of what the country will be when perennial irrigation with free flow is available over extensive areas.

From El Kaim near Abu Kimal right up to Meskene opposite Aleppo, the current is incapable of turning water-wheels, and the cultivation is confined to the areas flooded by the river or irrigated by lifting machinery.. From Abu Kemal to Der Zor past Meyadin the valley is very broad, and, judging from the ruins of towns and villages, must have been at one time well cultivated. To-day the cultivation is confined to the water's edge. From above Der Zor to Meskene past Rakka, the summer residence of Harun-el-Rashid, the valley contracts and the ground is covered with dense jungle, which supports very many buffaloes, sheep, and camels. Occasionally one meets a patch of rich cultivation, as at Meskene, where an Englishman had erected many water-wheels and was preparing to put up a 20 H.P. engine and pump.

The desert at Hit is flat, and only some 50 to 100 feet above the level of the Euphrates valley. This height gradually increases until at Meskene it is from 300 to 400 feet. For some miles on either side of the valley the desert is broken up into ravines; but as one leaves the river the desert becomes flat, and was described by Xenophon as being level like the sea. The further north one goes the more undulating becomes the desert, but south of Der Zor the undulations are insignificant. Here and there one meets a wady finding its way to the Euphrates valley. Gypsum is the ordinary rock, and there are considerable outcrops of limestone, while immense areas are covered with pebbles, and are known as haswa to the Arabs.

During the winter months the deserts are covered with grass and the hollows are sown with barley. This refers to the country past Hit. The rainfall increases as one goes northwards, and by the time one reaches Meskene the whole country is capable of producing barley with the aid of the rainfall.

The total length of the railway from Damascus to Baghdad will be 550 miles, which could be constructed for £2,200,000. This allows £4000 per mile along an easy alignment, while Nigeria is being developed by railways traversing more difficult country at £3000 per mile. According to the Beduins and the Turkish officers who annually escort the sheep from Abu Kemal to Damascus, water is sufficiently evenly distributed to allow of hundreds of thousands of sheep travelling from the Euphrates delta to Damascus.

In addition to the transport of the exports and imports of the Tigris-Euphrates delta, the railway from Baghdad to Damascus will be the highway for the merchandise of Persia and for all the Moslem pilgrims of Central Asia to the holy cities of Islam. It will carry all the materials and fuel needed for the future irrigation works of the delta, and when continued along the bank of the great central canal to Basra, it will be the shortest route possible between east and west, and will one day be carrying the mails between Europe and India.

Though zealously advocating the direct railway connecting the

Tigris-Euphrates delta with the Mediterranean, as without it the development of the country will not be possible, my hopes are centred in the delta itself, where it is my ambition to see the works carried out which we are planning to-day. I know that in these western countries of Europe, where rainfall is timely and abundant, and where ruin and disaster cannot overtake a country in a day, we are apt to imagine that works of restoration must also take long years to bear any fruit. But in the arid regions of the Earth it is not so. There, the withdrawal of water turns a garden into a desert in a few weeks; its restoration touches the country as with a magician's wand. In her long history of many thousands of years Babylonia has again and again been submerged, but she has always risen with an energy and thoroughness rivalling the very completeness and suddenness of her fall. She has never failed to respond to those who have striven to raise her. Again it seems that the time has come for this land, long wasted with misery, to rise from the very dust and take her place by the side of her ancient rival, the land of Egypt. The works we are proposing are drawn on sure and truthful lines, and the day they are carried out, the two great rivers will hasten to respond, and Babylonia will yet once again see her waste places becoming inhabited, and the desert blossoming like the rose.

The PRESIDENT (before the paper): Sir William Willcocks, who has very kindly undertaken to lecture to us to-night, has had very extensive experience in irrigation works, experience in India, experience in South Africa, and experience in connection with very extensive works in Egypt. He has recently been employed by the Turkish Government (the correct title of his office being Advisor to the Turkish Government), whilst his position may perhaps best be described as that of Director-General of Irrigation in Mesopotamia. Many distinguished civil engineers seem to content themselves, when on business, by merely looking at the country from the point of view of the hydrographical engineer, and with eyes for nothing else. In all the countries he has visited, Sir William Willcocks has always regarded them from the widest possible point of view, and his lecture to-night will deal not only with these interesting questions connected with irrigation, but he will also tell us many things of wide general interest. I will therefore ask Sir William Willcocks to be kind enough to address the meeting.

Sir HANBURY BROWN: I welcome this opportunity of associating myself with Sir William Willcocks and his work in Mesopotamia, even though by no more than speaking after his most interesting lecture. I know nothing about the subject except what I have learned to-night and on previous occasions from Sir William Willcocks himself. But as an irrigation engineer I am able to draw one broad conclusion from what I thus know. From the Lamentations of Jeremiah we may gather that Mesopotamia in olden times was rich and prosperous, by reason of its irrigation works, and that it became "a desolation, dry land, and a desert" when a flood overwhelmed those works. We know also that twenty-five years ago Egypt was languishing by reason of the decay of its irrigation works, on account of the inefficiency of its irrigation service. But what do we see in Egypt to-day? Last year Lord Cromer, at the Society of Arts, spoke of Sir Colin Scott Moncrieff and his

staff of British irrigation engineers as the "saviours of Egypt." Sir William Willcocks was one of that staff, and I feel confident that a man of his energy and determination, fertile in ideas and absolutely enamoured of his work, backed up by the wealth of irrigation experience which he has gained in India and Egypt—I feel confident, I say, that he will earn for British engineers in Mesopotamia the reward of such a compliment as Lord Cromer paid to the workers in a like field in Egypt. The four angels of the Book of Revelation, which were bound in the great river Euphrates, and which were loosed by the angel which had the trumpet, were destroying angels. They have done their work. But the time has come now, let us hope, when the curse shall be no more, and the waters of life of the twin rivers shall be guided through the land to make of Mesopotamia a new earth.

Colonel MAUNSELL: It would be very difficult for me to add anything to the extremely fascinating lecture we have heard, but as one who has travelled four times up the Tigris, I can only testify to the extreme heat of the climate, and the extraordinary difficulty there must have been in carrying out the work Sir William has done. It must have meant the most extraordinary energy and great devotion to duty. As regards new geographical work, he has entirely filled up several blanks on the map; the depression of Habbania and Lake Abu Dibis is quite new, and is not represented on any other maps. That survey is quite a gain to geographical work. Also further down the Euphrates, near its junction with the Shatt-ui-Arab, he has discovered a new channel which the river is forming for itself through the marshes; atlases have hitherto represented the channel going out to Kurna, but that has now become blocked up, and a large lake is forming north-west of Basra.

As regards the railway across the desert from Abu Kemal to Homs, the country is not really a desert; there are numerous wells, and I should think such a line would be perfectly feasible. Having travelled down the Hejaz railway, I think it would be even better than that as regards water-supply. From Homs to Tripoli there is a perfectly easy road at present.

Miss GERTRUDE BELL: All of us whose sympathies are deeply engaged on the side of the new order in Turkey will welcome the possibilities offered by Sir William Willcocks's scheme. It is full of hope. I do not doubt it would bring back into prosperity a great province, and I more than agree with him that with prosperity would come peace and order. I think it was Ibrahim Pasha who said that he who controlled the water-supply of a country controlled the country. That is quite as true of Mesopotamia as it is of the Nile valley. A water-supply firmly and equitably distributed would be a better asset in the hands of the Administration than an army corps. I am an old convert to Sir William Willcocks's railway scheme. His reasons for it are extremely cogent. It will be necessary to bring the stuff he looks forward to producing in such large quantities as directly as possible to the European markets, and impossible to bring it at any reasonable cost by the difficult and expensive route down the Tigris and through the Suez canal. I had hoped, however, that this railway was going to reach the sea, not by Damascus and Sidon, but by Aleppo and Alexandretta. Aleppo is now, and always has been, the centre of the traffic between the inner parts of the Turkish Empire and the sea. It is better suited for that purpose in many ways than Damascus. I know the Germans are proposing to tap the grain-growing region round Aleppo, but at the same time I should have thought that it might have been better to have made some arrangement with them rather than divert an ancient and well-known traffic line. An objection has been urged against Sir William's scheme, and was put forward long before any definite results had been given out to the world by him—notably, by Mr. Frazer in a book he published this spring. It was that the scanty populace of the delta would not afford Sir William sufficient labour for his great enterprises, far less supply the

necessary cultivators to occupy the land which he reclaimed. But it is difficult to over-estimate the mobility of labour in Oriental countries. This points to an economic condition in the Turkish Empire which it is important to bear in mind; everybody is short of a job. I am inclined to believe that the moment Sir William begins his work, he will find labour coming to him in great quantities, and from very distant parts of the Empire. The rumour of a fixed wage will speedily bring people to Mesopotamia, and as the land comes into cultivation, that which is not occupied by the local population will be taken up by these immigrants.

Sir COLIN SCOTT MONCRIEFF: We have had a very interesting lecture on a highly technical subject. I do not think I can say anything on that at a meeting like this. May I be allowed to put a postscript to our President's introduction, and to tell you a little about our lecturer to-night? He has told us about his work, but not about himself. I think perhaps I have known him for more years than any person here, and his life has been a very eventful one. Born and bred in India, he must have been above thirty years old before he ever saw London. He was a very little boy one day in the hot month of May, 1857, when a despatch came to his father from Delhi, only 20 miles off, to say India was ablaze, and the Mutiny was upon us. It was only through extraordinary risks and great danger that he and his party, the father, a very gallant soldier, the gentle wife, and five little boys, managed to escape. It was too much for the mother, but the boys, I am glad to say, are all men now, and have all faithfully served their country; one at the present moment commands the Peshawar Division of the army of India. When I went to Egypt in 1883, Sir William Willcocks was one of the first Indian engineers to join me. He had served under me in India for some years before. I think I may claim him as a pupil of my own, and, as very often happens, the pupil soon surpassed his master. His life in Egypt was full of event. I think I could tell some very good stories of it. For instance, how, walking after dark about midnight from the railway station to his boat on the Nile, he tumbled into an open grave, and when he stumbled out the watchman went at him with a stick, mistaking him for a demon. A remarkable chapter in his life was on one occasion when the Nile flood did not rise quite to the proper height, and a large tract of country in Upper Egypt was left without water flowing over it. There was a canal about 200 feet wide and 20 feet deep, which, if the water could only be held up in it for a few feet and diverted over the land, would do all that was wanted. Willcocks stuck his bed on the bank of the canal, got together the peasantry of the whole province, and for three days and nights worked at it till the water rose and flooded the plain. The people were so delighted with what he had done, that they went to their mosque and insisted that this Christian should go with them and bow down with them and thank God. This is a very unique experience. You can understand from these little traits what Sir William has been doing. He is not the conventional type of man. I am sure that after to-night the allusions we see to him from time to time will all bring to us an interest which we had not before. I have no more to say.

The PRESIDENT: In bringing this discussion to a close, I am sure I can, in the name of every one here present, thank Sir William Willcocks most heartily for his most interesting lecture. I am sure we all feel proud that the Turkish Government has asked a fellow-countryman of ours to direct this beneficent work of converting these arid regions into a Garden of Eden. It is not only thanks we wish to give him; we wish him to know, when he sets out on Friday next on his return journey, that he goes with the earnest good wishes of every one present that his great work will bring forth the full fruit which we confidently anticipate.

Sir WILLIAM WILLCOCKS: I think many people who say that Mesopotamia is a poorly inhabited country all go down the Tigris in the steamers and see nothing. If they would only go down the Euphrates from end to end, they would see that the population is very numerous and very energetic and strong. As to the railway to Aleppo, I do not think, when Miss Bell said that was the ancient route, she was correct. Aleppo is the outlet for everything from Mesopotamia westwards; but from Baghdad westwards Tyre and Sidon have been from ancient times the outlet, and will be again. I think the road to Damascus is the best. I am very much obliged for the kind way in which you have received my paper.

JOURNEYS IN BHUTAN.*

By J. CLAUDE WHITE, C.I.E.

BHUTAN is a country hitherto almost unexplored, and I have been more than usually fortunate in making no less than five distinct journeys through it, and it is of these journeys I propose to give a short account this evening.

The first journey, in 1906, was when I followed the course of the Am-mo-chhu from Chumbi to the plains in connection with the proposed construction of a cart-road. The valley is densely wooded and practically uninhabited, and was interesting mainly on account of its fine vegetation and beautiful scenery. The second journey, also in 1906, was made from Gangtak *viâ* the Natu-la to Chumbi, and then *viâ* Hah, Paro, Tashichojong, and Poonakha to Tongsa and Byagha, on the occasion of the investiture of the Tongsa Penlop with the insignia of the Knight Commander of the Indian Empire. The third journey, in 1907, was along the boundary between Bhutan and British India, from the Jaldakha river to the Gadadhar, and from Doranga to the eastern boundary, and again from Doranga across the Dongma-chhu to Kenga, and a further two days' journey up the Kuru river. In 1907, from Dewangiri through Kheri, Tashijong Tashiyangtsi, across the Dong-la to Lingzi and on to Pangkha, Singi Jong and across the Bod-la to Lhakhang Jong in Tibet. From Lhakhang I followed up the western branch of the Lobrak river to Lhalung monastery, and crossing the watershed entered the Chomo-chang-thang lake basin, and thence to Gyantsi. In 1908, from Chumbi *viâ* Phari to Paro, and on to Poonakha by the route I followed in 1906, in order to attend the installation of Sir Ugyen Wang Chuk as Maharaja, and on my return journey I followed a new route from Paro *viâ* Bite Jong and Dungna Jong to the plains, which I entered at Jaigon.

I will pass at once to my second journey, as that through the

* Read at the Royal Geographical Society, December 8, 1909. Map, p. 104.

Am-mo-chha valley calls for no special notice beyond that the scenery and vegetation were both particularly fine.

Throughout the whole length of the central zone of Bhutan, a well-aligned road runs from west to east, and crosses the ridges separating the various valleys by easy passes from 10,000 to 13,000 feet high, and it was along this road that I travelled in 1906. The road from Gangtok to Rinchingong has often been described, but from Rinchingong, where the old road crosses by a substantial bridge to the left side of the Ammo-chhu, no description has been given. The views down the valley were most beautiful, and the trees very fine. Crossing what was marked as the Lang-marpu-chhu, but is really the Kyunka, by a new bridge, we came to what is known as a cave, or rather two overhanging rocks, which lie in Bhutanese territory. Our old maps are wrong; the true Lang-marpu-chhu is more to the north, while the stream marked by this name is really the Kyunka. At the head of the former stream there is said to be a lake and also favourite ground for the shau, the great Sikkim stag, *Cervus affinis*. A narrow track through woods took us up the Kyunka, to our camp at Lhare, a somewhat confined glade close to the stream. Above this, as we ascended the Kyunka, the road improved greatly and the country opened out, though we were twice obliged to cross the stream by strong bridges.

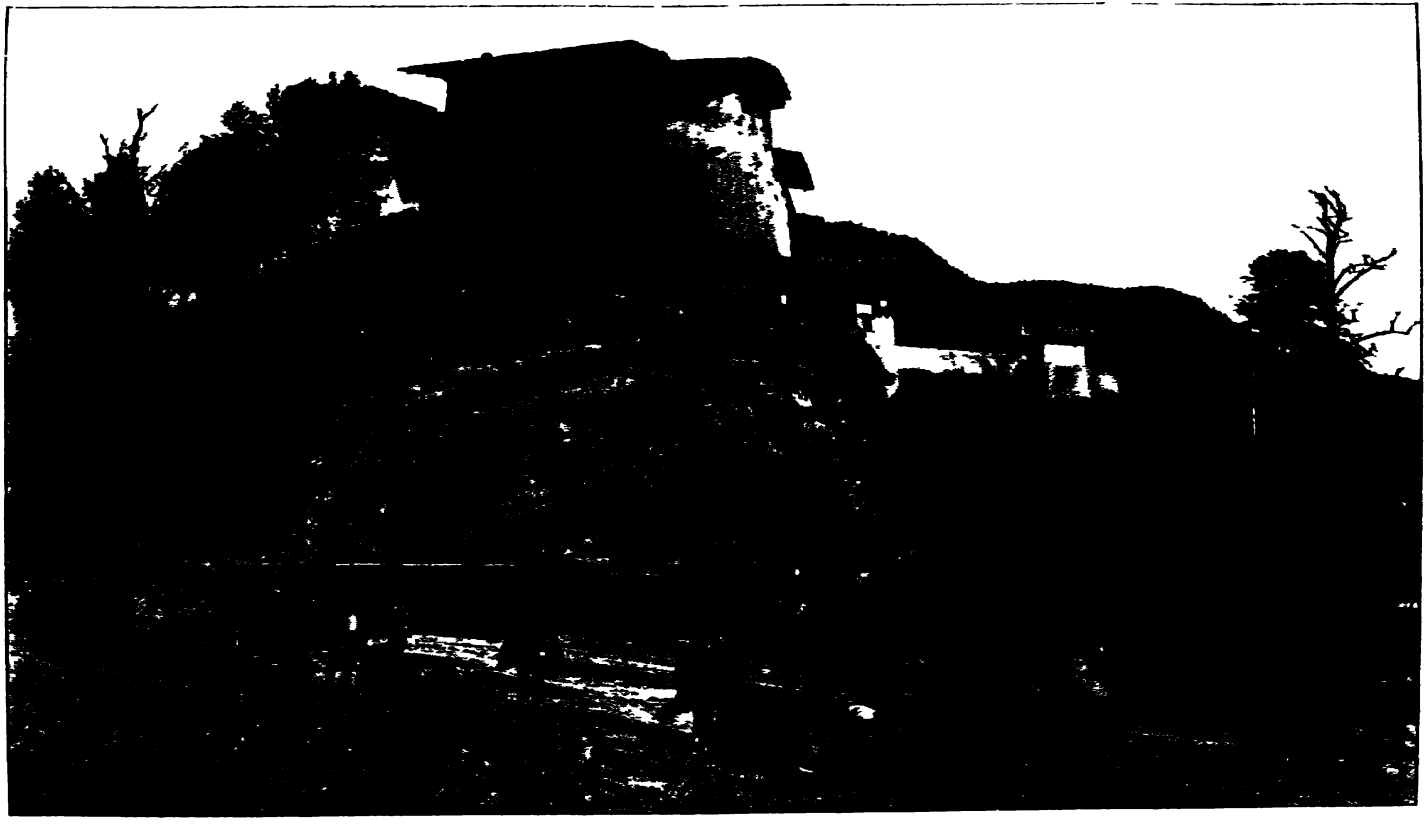
On the other side of the Chalu-chhu (one of the tributaries of the Kyunka) the valley widened out into most delightful glades and upland swards, forming rich grazing-grounds. Here grew in graceful abundance spruce, larch, silver fir, holly oak, various pines and rhododendrons interspersed by grassy meadows, while the view down the main valley had the appearance of a gigantic avenue, leading up to the snowy pyramid of Gipmochi. Out of this a somewhat steep ascent round a grassy knoll leads to the Dongma-chhu, up which runs another track to the head of the Lang-marpu-chhu, and thus by a northerly but difficult path to the Hah road. The main route leads across the Lungri Sampa up a steep and stony way to Tak-phu, a somewhat bare and extensive flat, well within sight of the Kyu-la. Timber was plentiful, and our camp was further protected by the walls of two parallel moraines; the valley, indeed, was full of lateral moraines, forming gigantic spur works to keep the modern river within bounds. At the same time, so far from these moraines being barren stony walls, they were luxuriantly covered by virgin forest right up to the top of the parent ridge. Snow fell, and in our camp, 13,400 feet above sea-level, we passed a very cold night, there being 18° of frost.

Passing through an extensive amphitheatre, bare and devoid of tarns, the Kyu-la, or rather the long ridge which forms part of the pass, was soon reached; but we had to proceed nearly half a mile along it before we could descend into the wilder amphitheatre of rock and snowfields which lies between the Kyu-la and the Hah-la (or Meru-la

of our maps). This half-basin forms a veritable death-trap in bad weather, as there is neither fuel nor shelter to be found anywhere within its horns. The view from the Hah-la is magnificent; a particular feature in the panorama being a grand but unknown snowy ridge, which ends abruptly on the south-west in a tremendous precipice, where the Am-mo-chhu probably finds an outlet towards the plains.

On the east we looked down a well-wooded but somewhat deep and narrow valley, and through this we descended by a very rough steep track, which, however, improved greatly when a small open glade was reached. The road here turned slightly to the south, down the main valley. It is impossible to describe the beauty of the scenery: grassy glades, gently sloping, opened on a succession of broad valleys in the far distance; on either side, and at our back, was a deep fringe of fine trees of every age, from the patriarch of the forest to tiny seedlings. From the time we left Rinchingong, we had passed through forests without exception self-reproducing, thus showing that the Bhutanese understood the secret of combining in their forests self-reproduction and unrestricted grazing. A good road brings the traveller into the main valley, which greatly resembled an Alpine scene, of magnificent description, with a temple or a monastery on every commanding promontory. Ke-chuka, the first large village we came to in Bhutan, contained a fine sample of a Chuten or cube of prayer, its rectangular form marking a strong contrast to the cylinders of Sikkim and Tibet, while two flour-mills worked by water bore testimony to the prosperity of the villagers. At Kyengsa a road leads up a side valley direct to Duggye jong, which guards the road from Paro to Phari. Yangthang is a large long village situated on the left bank of the river, but numberless irrigation channels have tempted the Hah-chu to forsake its natural bed, and much stony barren land is the result. The formation of the hills is markedly of crystalline limestone, and there are several mineral springs to be met with. The large village of Tumphiong, the chief station of the district, possessed twin forts of no particular strength or beauty; the houses have once been large and prosperous, but are now in a decayed condition. There are curious holes in the limestone formation on the left bank of the river, which seem to connect the river with some subterranean lake; the villagers place baskets at these outlets, and the rush of water at times brings out a number of fair-sized fish, though none are to be seen in the Hah stream itself. The Hah monastery is situate some way up a side valley and commands a magnificent view; it is in good order, but the Poisoners' Chapel, mentioned by Eden, was neglected, and appeared of little interest.

Our route was over a very good bridle path, rideable the whole way to the Chiu-li-la; but the weather, unfortunately, was very damp and misty, and we obtained only occasional glimpses down the Hah valley,



DUGGYE JONG



DUGGYE JONG

which runs fairly straight as far as Do-ri-kha, where Eden camped, and whose route in 1864 we were now supposed to be following. High up on the right was the nunnery of Kyila, built on the face of a very steep precipice, most difficult of approach. No male creature is allowed to remain within the precincts of the establishment, and it is said to contain sixty nuns; but as there were more than twenty-five houses, the majority quite large ones, this estimate of the inhabitants seems much too low. Cha-na-na, a small hamlet of some half-dozen houses in a ruinous state, was our halting-place. Our experience in crossing the Chia-li-la was so different in every respect from Eden's that I cannot but suspect that he was deliberately misled from the proper path on to some mere cattle track.

A little below Cha-na-na the path emerges on a well-wooded spur, with a grand outlook over the courses of the Pa-chhu and its affluents, running through a broad, well-cultivated tract of country which could under good management grow every description of temperate crops. On a distant mountain the monastery of Danka-la has been built in such a conspicuous position that it can be seen even from Poonakka; while Beila Jong, which we subsequently passed on our way from Paro, was visible eastwards. To the north lay Dug-gye-jong, dominating the main road to Phari, and deriving its name from a notable victory over the Tibetans; while at Gorina was the monastery which a former Shabdung Rimpoche used to make his summer retreat. Owing to the more favourable climate and country, the monasteries of Bhutan, unlike those in Tibet, are not confined to one huge building or close cluster of dwellings, but consist of houses scattered over the slopes of the hills, each one surrounded by a pretty garden. The chapel at Gorina was bright, clean, and decorated in good taste; while the frontal hangings, overlaid with an exquisite lacework of brass, were superior to anything to be seen in Lhasa. The chuten was a very fine one, having on one of its faces a large brass plate, with a Buddha deeply embossed thereon.

On the ridge below we were received with a salute fired from iron tubes bound or covered all over with leather, which are probably the leather cannons of which we heard so much in the Chinese Goorkha wars. The Paro Penlow's band and richly caparisoned mules were in attendance. Down to Paro the road passes over a deep red clayey slope, impassable in really wet weather.

What struck me most during the last march was the total absence of rhododendrons, and the change from gneiss first to crystalline limestone, sandstone, and dark shales; then to heavy red clay deeply impregnated with iron; and finally to a blueish-grey limestone.

The fort has been built on a limestone bluff overhanging the river; there is only one entrance from the hillside, and this the third story; the lower stories are only partially existent, as their walls seem in great

part to be a mere casing to the solid rock. A heavy bridge over the fosse separating the fort from the rest of the hill leads to a huge gateway, and within this a sharp turn to the left opens upon the eastern courtyard containing the smaller of the two citadels or towers, which is occupied by petty officials. Against the inside of the south and north outer walls are built a series of rooms and verandahs; on the west front directly above the river there is a covered verandah, one story only, from which the balista or catapult, which is still stored there, was worked. The Penlow's quarters are on the first floor in the south-east corner. The reception-room was large, airy, finely decorated, and its walls hung with arms of every description. The opposite corner of the enclosure has a larger suite of apartments reserved for the Deb Raja and other distinguished guests. On the first floor of the main citadel is the public temple or chapel, a very finely proportioned hall with two tiers of well-lighted galleries. All the decorations were good, a hanging lattice of open brasswork being specially effective. In the west corner of the main courtyard was the private chapel of the Ta-thsang or state monks, whose head lama Kun-zang accompanied the British Mission to Lhasa.

Three of the outlying forts, Tazo-jong, Donam-jong, and Suri jong, are existent, though in bad repair, but the very large one of Chubyak-jong is entirely in ruins. Dug-gye-jong is situated some 9 miles up the broad valley of the Pa-chhu, described by Turner "as a fortress built upon the crown of a low rocky hill, which it entirely occupies, conforming itself to the shape of the summit, the slope all round beginning from the foundation of the walls. The approach to the only entrance is defended by three round towers, placed between the castle and the foot of the hill, and connected by a double wall, so that safe communication between them is preserved, even in times of the greatest peril. Around each of these towers, near the top, a broad ledge projects, the edges of which are fortified by a mud wall, with loopholes adapted to the use of bows and arrows, or of muskets. On the north of the castle are two round towers that command the road from Tibet. On the east side the rock is rough and steep; and close under the walls on the west is a large reservoir.

The castle itself is a very substantial stone building with high walls, but so irregular in its figure, that it is evident no other design was followed in its construction than to cover all the level space upon the top of the hill on which it stands. The gateway at the foot of the walls which crown the hill opens upon a flight of a dozen steps, within a narrow passage leading to a semicircular platform, edged with a strong wall pierced with loopholes. A turn to the right leads through a second gateway and along a wide lane, with stables for horses on each side; and a third gateway opens into the interior of the fortress, which forms a large square, with its angles occupied by three suites of rooms,

In the centre of the courtyard is a square citadel several stories high, and containing temples or chapels. The whole place was very clean. The armoury is said to be the most complete in the country, and is contained in a fine room, with a large bow-window facing south, and affording one of the prettiest views in Bhutan. The inner court contained piles of large pine shingles, intended for the repairs of the castle roofs, which have to be done every five years.

The road running from Paro eastwards is very rough and steep up to the Tazo-jong, the curious rounded fort described by Eden as a building formed of two semicircles, one large and the other small, built up one against the other for about five stories high. So far the regular road had evidently not been repaired for many years, but farther on it was good and ascended very gradually to the pass near Beila-jong (8900 feet). On the other side a less gradual descent leads to Pemithang, the seat of a small official, or Penlow.

From Pemithang there are two routes to Tashi-cho-jong—a direct one across the hills *viâ* Pame-la, the other down the Pemi-chhu, and so round by the Tchin-chhu; we chose the latter. The road was good, and the valley thickly wooded and full of flowering pear and peach trees; but on turning eastward up the Tchin-chhu the whole aspect of the country changed to barren hills with sparse and stunted trees. Our camp was at Chali-maphe, not far from the fort of Simtoka. Here was the gigantic cypress, which Eden records as measuring six spans round in 1864. We found it to be 50 feet round the trunk at 3 feet from the ground.

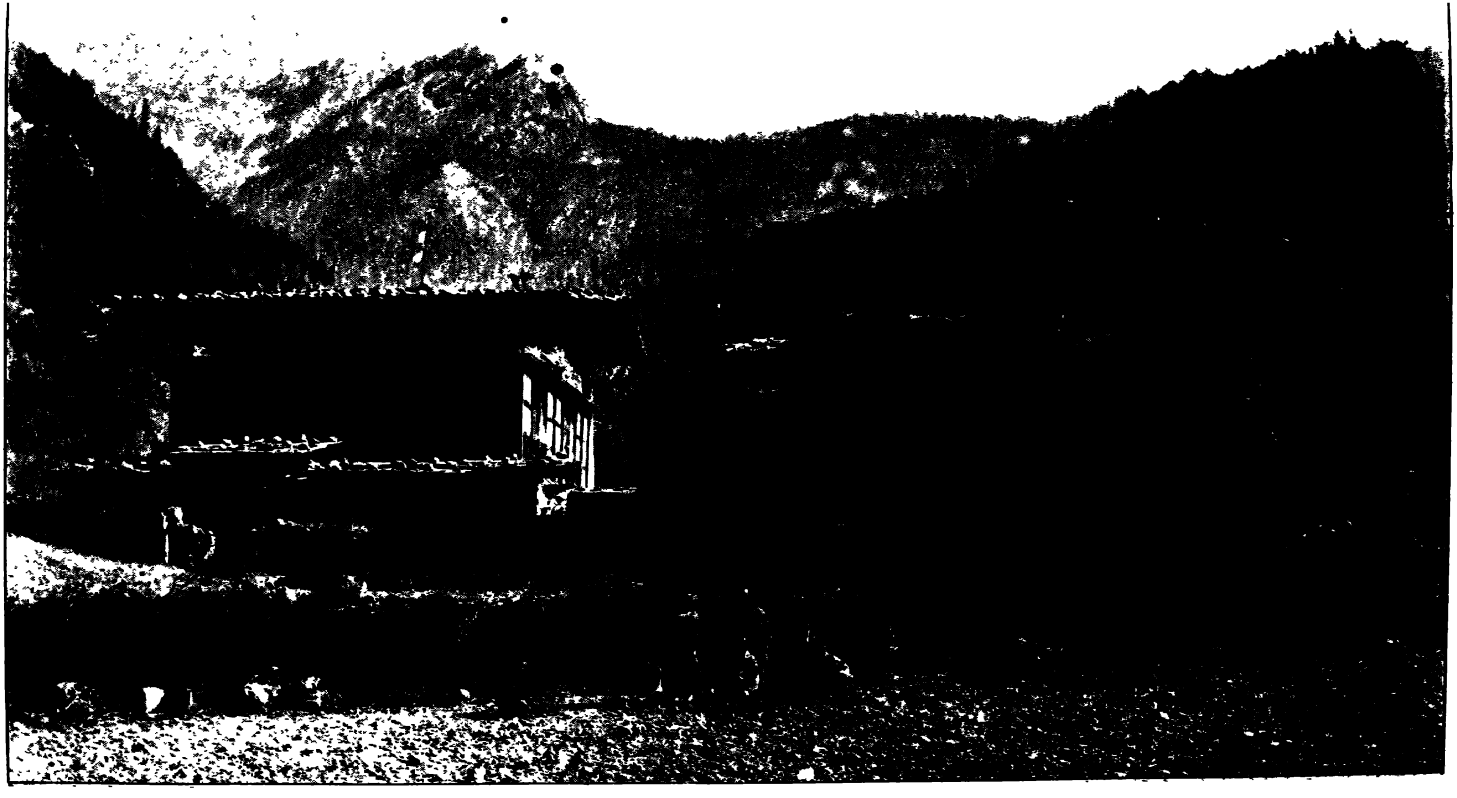
Tashi-cho-jong, the summer capital of Bhutan, lies to the north, up the broad valley of the Tchin-chhu, but as our destination was Poonakha, the winter capital, we took the road leading up the Lhung-tso valley. A short distance above the junction of the two streams, Simtoka fort occupies a projecting ridge, separated by deep gullies from the main hill. The present fort was built by Shabdung Rimpochi in 1873, as the first one, completed in 1870, had been treacherously seized and burnt by his enemies; a scorched pillar belonging to the original building, now almost hidden by elaborate carving, is still pointed out as an object of reverence. In the chapel is the finest statue of Buddha to be seen in Bhutan. It is placed under a magnificently carved canopy, and supported on either side by a number of standing figures more than life-size. Round the plinth of the central tower runs, not a row of prayer-wheels, as is usually the case, but a number of square slabs of dark slate, carved in low relief, with pictures of saints and holy men.

The road up the valley to the Dok-yong-la is a very good one, running through beautiful glades of oaks, willows, chestnuts, and rhododendrons, while on the higher slopes forests of *Pinus excelsa* reappeared, in pleasant contrast to the barren hills of our previous march. On the east of the Dok-yong la we entered a valley, which, in the dampness of

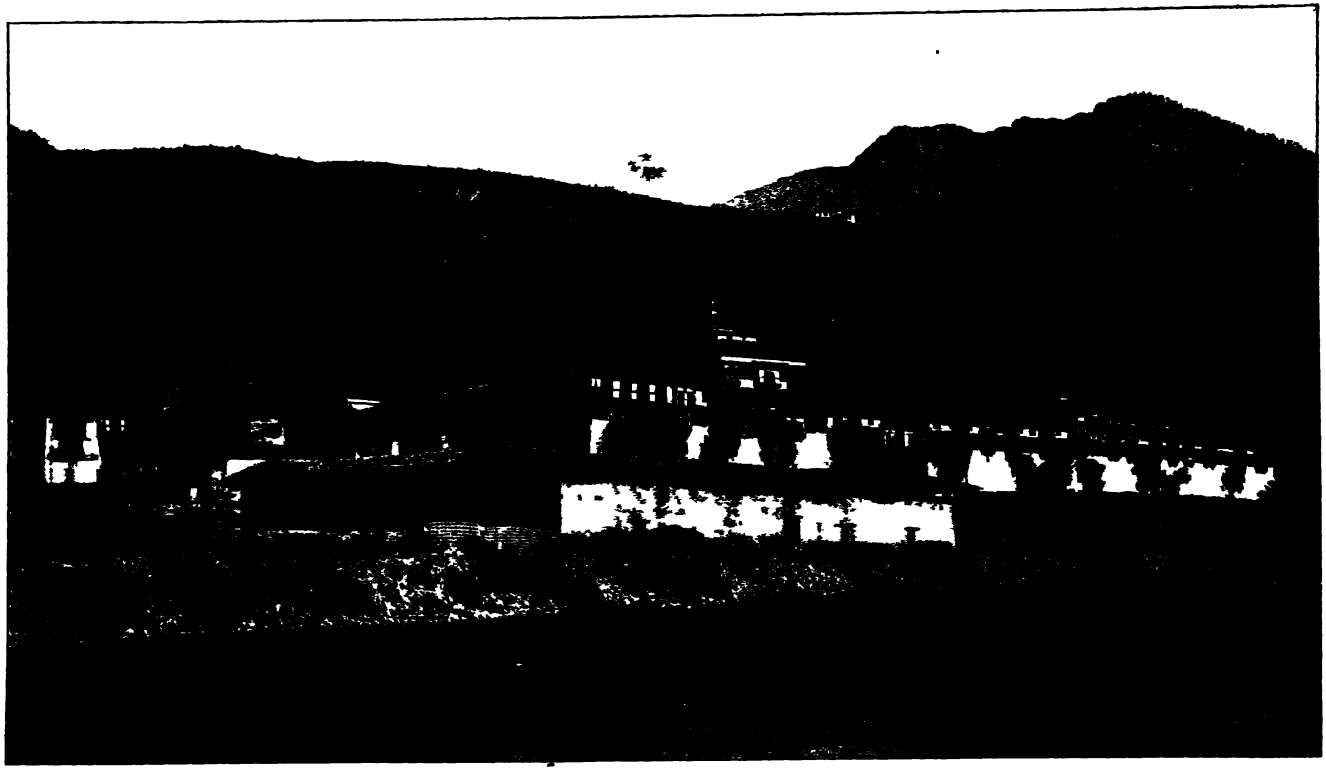
its climate, was suggestive of Sikkim rather than of Bhutan; the path to our camp at Lungme-tsa-we and on to the Teo-pa-rong was steep and slippery, and only redeemed by the beauty of a species of rhododendrons and huge pear-trees. From our camp at Jon-chung-dorong, the mission, headed by a picturesque procession of musicians, dancers, gunners, gaily caparisoned mules, etc., started on April 20, with the intention of making a triumphal entry into the capital of Bhutan, in spite of the difficulties caused by the heavy rainfall and the clayey road. The mission remained at Poonakha until May 2, to enable me to carry out the duties for which I had been sent. The Durbar, at which the Insignia were presented to Sir Ugyen Wank-chuk, was most interesting, but a description of the ceremony would be out of place in a geographical lecture.

The castle of Poonakha looks best from a distance, occupying as it does the whole narrow promontory between the Pa-chu and Ma-chu immediately above their junction. It has the usual towers and court-yards, and was built by the first Shabdung in 1577, and designed to hold six hundred monks: their number has increased since then, and the body ecclesiastic now occupy the whole of the southern third of the building. The two rivers are spanned by fine cantilever bridges of the same style as that at Paro. The earthquake of 1897 was felt here very severely, and the destruction then wrought has not been wholly repaired.

The Ta-lo and Norbugang monasteries are situated high up on the mountain to the west. The track, if it deserves even this name, must be absolutely impracticable during rain, as it runs entirely through clay. As far as Norbugang, about two hours journey up, the hillside was bare and uninteresting, but afterwards the path improved and ran through several pretty glades, where the pear and clematis blossoms were beautiful. After three hours of hard climbing, the monastic colony of Ta-lo was reached: small, well built, two-storied houses, with projecting verandahs and painted fronts, were scattered all over the hillside, each in its little garden of flowers and trees, with here and there a chapel or a picturesque chozten, to break anything like a monotony of houses. The great temple above stood sharply out against a sombre background of cypress and pine: while higher up the small but beautiful retreat of the late Dharma Raja formed a fitting crown to the whole group of buildings. In the great temple were many chapels kept scrupulously clean with, strange to say, glass window-panes. The principal objects of interest were the two large choztens containing the ashes of two of the Shabdung Rimpoche's: they were of silver, highly chased and jewelled, the stones being mostly turquoise of large size but little value. The ceremonial implements used by the late Dharma Raja were fine examples of the best Bhutanese metalwork. The carving of the pillars and canopies was excellent, but so much overladen by open metal scrolls that it was difficult to follow in detail. There was a



FARM HOUSES, PARO VALLEY.



TASHI CHO JONG THE SUMMER RESIDENCE OF THE BHUTAN GOVERNMENT.

magnificent collection (both here and at Norbugang) of banners of embroidery and applique work, and before one of the altars an elephant's tusk measuring 8½ feet.

About 2½ miles up the Mo-chhu above Poonakha are the ruins of a small fort called Sona-ga-sa, mentioned by Turner under the name Zemri-gatchi, and formerly containing the great printing establishment of Bhutan and a fine garden house for the Deb Raja. It was totally destroyed by fire about eighty years ago during one of the many local civil wars, and all the records unfortunately lost, and only a few flowering plants remain to represent the garden. Not far off is a sort of cave or arched recess, which has been formed by percolations of lime bonding together the pebbles of a bank, and in which, nearly three hundred years ago, Nagi-rinchen, a saint from India, is said to have lived. The river here is full of fish, and the resort of many cormorants and gulls. The road up its course into Tibet divides above into two branches, guarded respectively by the forts of Ling-zi and Ghassa. It is rumoured that gold has been found on the mountain ridge between the Mochu and Pacho

The Bhutanese Government removes from Poonakha to Tashi-chojong at the end of April, so after finishing my work I left Poonakha on May 2, in order to visit Sir Ugyen Wong-chuk's seats at Tongsa and Byagha in the east. The road to Angduphodang is on the left bank of the river and close above it, and the descent is very gradual, not more than 25 feet in a mile, through a valley which is well cultivated, and once must have been thickly populated. The abutments of at least two chain suspension bridges not only betoken much former traffic, but also show how long these mountain streams keep to one channel, for no alteration appears to have taken place since Turner's visit to Angduphodang 130 years ago; and yet there are no sufficiently solid rocks nor guiding spur works to restrain the current. When in full flood the river looks very fine. Turner's picture of the bridge and fort holds good up to the present time. The channel which brings water to the upper fort is nearly 6 miles long, and clearly demonstrates the skill of the Bhutanese in irrigation works. The road eastwards runs just below this channel until it joins the Ba-chu near Chapakha. Up to this point the scenery was poor, and the road hot and narrow, but, on crossing the Ba-chhu, a stiff climb brought us to Satengong, a very picturesque flat overlooking both the Ba-chhu and Tang-chhu, and distinguished by a clump of pine trees, a small lake, and beautiful flowers.

The road eastwards was most excellent, and rendered interesting by the constantly changing scenery on the isolated island hill between the neighbouring rivers. The ascent continued gradual up to Tsha-za-la, and then an equally gentle descent led to a curious deeply cut ravine, where the main range begins. The Tang-chhu is crossed at the village of Ra-tso-wok, a name which betokens its Indian origin, and a good and

very pretty path is lost at Ridha in a fine open space with plenty of flat ground, above which the village houses are clustered on a knoll. There were fine views up to the snowy range whence the Tang-chhu takes its rise to traverse many miles of a rich valley. The march hither was one of the most beautiful which we made during the tour, for the rhododendrons were in flower, and the oaks, chestnuts, and walnuts, with their young foliage, made delightful colouring in the scene. In every direction there was evidence of better cultivation and more prosperity than in any valley we had traversed. Unfortunately, the inhabitants are said to be very quarrelsome, and constant litigation (which means heavy bribes to the officials called in to decide their cases) has tended to keep the villagers more impoverished than they ought to be. Judging from our experience of the Pele-la, both in going and returning, the main ridge here must be the focus of a wet zone, extending as far as Tongsa, damp being drawn up from the plains through the narrow gorges of the Madu-chu: certainly we had worse weather here than anywhere else in Bhutan. The road, though well aligned, paved in many soft places and corduroyed in others, was, owing to the wet clay, very difficult to traverse. The country on both sides was a succession of wide open glades affording excellent grazing stations, and timber was abundant.

On the eastern side of the Pele-la were several large villages at Rokubi and Chandenbi. Not far from the latter place is a charming patch of sward covered with beautiful cedar pines, and situated in a gorge of the ravine, where the Siche-chhu is joined by another mountain torrent. On this tongue of land thus formed were two mendongs (walls of prayer) and a fine chorten, a copy of the Swayambunath in Nepal. From this spot the road ran at the same altitude through oak, magnolia, and rhododendrons for some miles before emerging at Tashiling on more open country, which continued as far as Tshang-kha, high above the raging torrent of the Madu-chhu. Here we camped. Beyond Tshang-kha the road almost immediately enters very rough country, the gorge through which the river flows narrowing considerably, and being flanked on either side of stupendous precipices. As it descends the road becomes a series of steep zigzags, mostly made up of stone steps, and this kind of path continued to within a short distance of the cantilever bridge, which crosses the Madu-chhu some 900 feet below the castle of Tongsa. Another steep zigzag with many flights of stone steps leads up to a small door in an outlying bastion of the walls of the castle, which blocks the way and overhangs the cliff up which the road runs. Passing through a large stone-flagged courtyard, the traveller emerges through another gateway to the east on a narrow path above a second ravine. It will thus be seen that Tongsa castle completely covers a ridge between two steep ravines, and effectually bars all progress from east and west. We camped for a couple of days on a pretty knoll, which, being clothed in

fine trees and provided with an excellent stream of water, running over cascades into a fish-pond, is the pleasaunce of the Tongsa monks. The fort consists of several courts, but suffered from the great earthquake, and the eastern citadel had not been completely restored at the time of my visit. A women's choir formed part of the procession sent to play us into the castle—a curious performance which is mentioned in Pemberton's report.

A steep ascent leads to the outlying fort, which commands the castle itself. A good and easy road runs onwards over the Yo-to-la and down to Gya-tsa, the Faisa of Griffiths, who notes that it is "a good-sized village, comparatively clean, and with houses which were, he thought, better than most he had seen." The country through which we marched had again changed from a system of narrow gorges into a series of broad valleys, the upper ones grazed over by hundreds of yaks, the lower rich with barley, buckwheat and mustard fields. Dotted in their midst were erected temporary huts to shelter the cultivators during their stay in these higher elevations at the time of ploughing, sowing, and reaping, while down in the valley more substantial permanent dwellings proved that the district was better governed and more prosperous than any other we had seen. An easy road leads over a saddle on the Ki-ki-la and down into the valley of Chamka-chhu, where at different elevations are the castle of Byagha in the middle, Sir Ugyen's private house above, and his sister's below at Angducholing. Dr. Griffiths wrote, "The country was very beautiful, particularly in the higher elevations, but we saw scarcely any villages and but very little cultivation." Within the last thirty years this state of things has been remedied, and under the present more stable government conditions have greatly improved. The fort of Byagha was totally destroyed in the great earthquake, and has been rebuilt on a smaller scale—a remark that also applies to the residences of Sir Ugyen and his sister.

The route to Lhasa past Kulha Kangri lies up the valley of the Pumthang, and in a subsequent journey my baggage had to go by this route, as the direct route from Tashiyangtsi up the Lobrak was not passable. The site of the Sindhur Raja's palace is shown 2 miles above Angducholing. This prince was converted to Buddhism by Padma Jungne early in the eighth century of our era; the saint's resting-place is held sacred, and the depression in the rock, where he leant against it, has been roofed in and made into a gorgeous shrine.

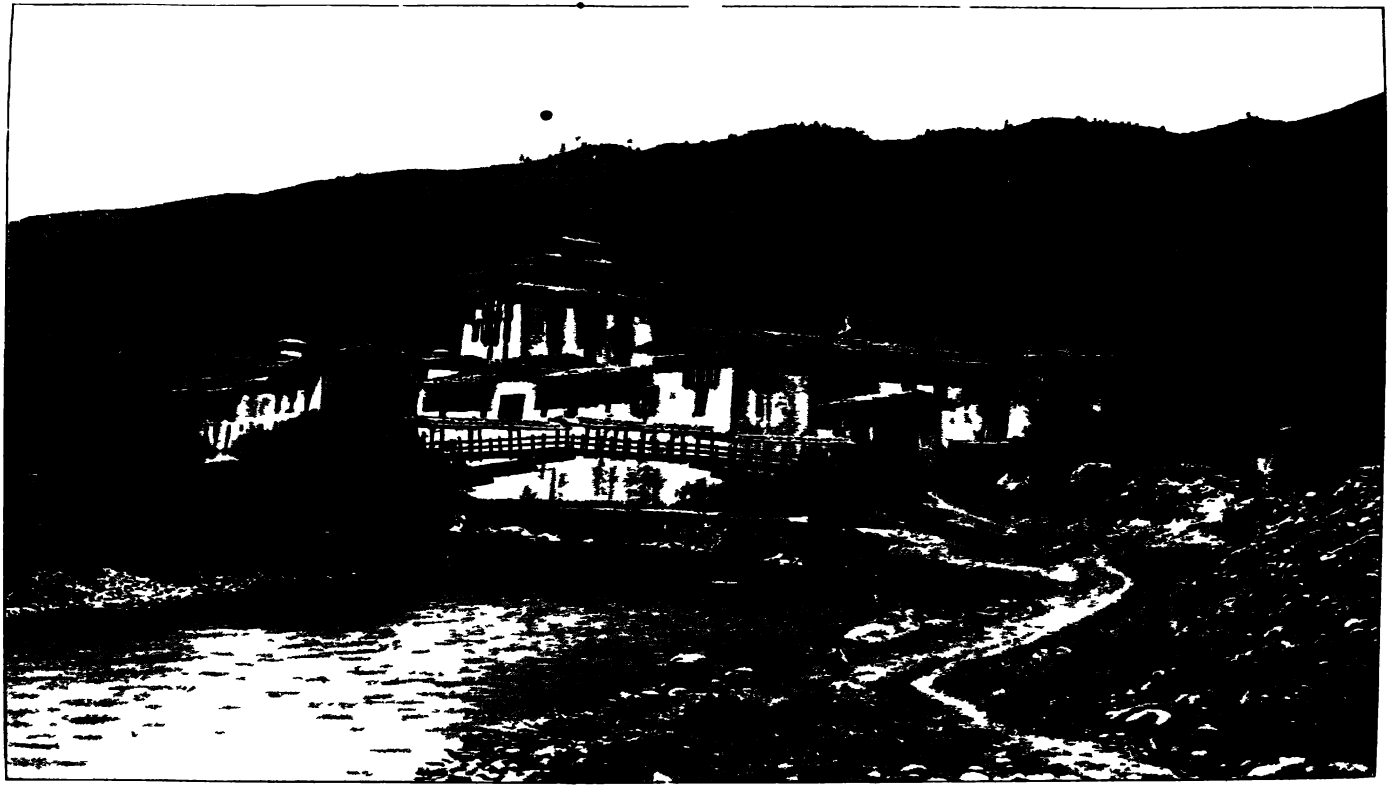
On our return journey to Simtoka the scenery appeared even more lovely owing to the immense number of flowers in bloom—three kinds of yellow roses, clematis, wild pear, and rhododendrons were in wild profusion, while the meadows were literally carpeted with blue-and-white anemones, yellow pansies, and countless primulas. The giant Sikkim primula was in magnificent bloom, some plants having as many as six tiers of flowers. Each day brought out new kinds—a large

white rose, a white and a mauve iris, and the giant white lily appeared for the first time. Orchids were abundant, and it seems a pity that the *Cypripedium Tibeticum* does not figure more in our shows, as the flowers we gathered were, as a rule, larger and finer than that figured in 'The Orchids of the Sikkim Himalaya.'

At Simtoka we crossed the Lhung-tso and proceeded up the broad valley of Thimbu-chhu or Tchin-chhu to Tashi-cho-jong, passing *en route* the knoll of Changlingmethang, where, in May, 1885, the then Poonakha Jongpen was killed, Aloo Dorzi defeated, and the supremacy of Ugyen Wangchuk's party so firmly consolidated, that there has been no revolution or internecine strife in Bhutan for the past twenty-four years.

Unlike other Jongs, the present Tashi-cho-jong has been built on the plain; it differs also from other forts in having two large gateways and in being protected on the west and north by a wide fosse filled with water. The bridge across the Tchin-chhu is not connected with the castle, as at Paro and Poonakha. The interior is arranged in a succession of courtyards, as in other castles; the northern portion being set apart for the monks. The main tower was destroyed by the earthquake; the new one was carelessly built on the old and shaken foundations, and already shows signs of serious subsidence. The original castle stood on a spur about a mile away near Dichen-Phodang; but having been damaged by fire, Deb Jidhur, at the end of the eighteenth century, removed the materials to the present site and rebuilt them there. We found the Deb Raja and his court comfortably established for the summer, having completed their annual migration from Poonakha.

After taking formal leave of our hosts, we marched north up the Tchin-chu valley, which for some 3 or 4 miles was open and well cultivated. Turning over a steep bluff, we entered an entirely different country as the valley narrowed considerably, and, being beautifully wooded, was picturesque to a degree. Our destination was Chari, the first monastery founded by the great Shabdung Rimpoche; it is terribly difficult of access, being perched on overhanging rocks, so that to get from the lower to the higher chapel it is necessary to climb up very narrow, rough stone steps, squeeze round the corner of a precipice, and descend other steps to the platform of the temple, which is literally clinging to the cliff. No wonder the Shabdung's enemies attacked it in vain. We now entered the narrow gorge that leads from the middle zone to the upland pastures. At first there was no road along the stream, but our path took us high up the hillside, where we had to round cliff after cliff, all well wooded, until we slightly descended to a small open side valley, in which the fort of Barshong is situated. From this place for some 10 miles the road was close to the stream, which had to be crossed and recrossed about six times before it emerged



POONAKHA WINTER RESIDENCE OF THE BHUTAN GOVERNMENT.



VILLAGE OF NORBU-GANG.

on to the open uplands below Byaradingka. The gorge was almost filled by the Tchin-chhu, and bordered by stupendous cliffs of most weird shapes. These cliffs appeared to be formed of horizontal strata of sedimentary rocks, consisting of layers of limestone, sandstone, slate, or shale of a dark blue colour, and quartzites, and were cleft in many places from top to bottom, thus leaving narrow slits or fissures, often more than a mile long.

From Byaradingka an hour's gradual ascent led to the Yakleh-la, whence the road descends somewhat sharply to the Pimnakme-chhu, a stream which joins the Mo-chhu below the fortress of Ghassa. A few miles down the valley, Lingzi-jong suddenly appears in sight on a hill that seemingly blocks the valley; we had, however, to round several ridges before reaching our camp some way below the Jong. The fort was totally destroyed by the earthquake, and has not been rebuilt. The road rounds several ridges before making the final ascent to the Phew-la ridge, which separates Bhutan from Tibet. At Gangyul, a little village on the Tsango-chhu, the view of the Chumolhari glaciers is magnificent. A fair bridle-path leads along the left bank of the Tsango-chhu to a small but flourishing side valley, blocked at one end by a gneiss cliff, extending from side to side in a perfect level, over which poured a very fine waterfall. This little valley was well cultivated, and possessed many large juniper trees. The path brought us at an easy gradient to the top of the cliff, which we then discovered was the lower edge of another long level valley. In this way we progressed by a succession of steps, until we came to the last tread of the stairway, which was an almost precipitous slope of stones and rocks, up which our yaks and mules struggled slowly but surely, the zigzag, as far as alignment went, being very good. Above this was a small roundish flat, in the centre of which were the walls, still good, of the fort built by the Tibetans during our late troubles. A short incline leads to the pass, 16,400 feet, whence is obtained a magnificent view of the plains and hills of lower Tibet. The contrast between the fertility of Bhutan and the barrenness of Tibet is startling.

On my third journey along the boundary of Bhutan I traversed a great part of the outer range of hills, and was enabled to judge of the suitability of this ground for Nepalese settlers, of whom large numbers were entering the country, and also of the extent of the forests as well as the amount of damage said to be done by the cultivation of the outer and very wet slopes causing landslips, and consequently raising the river-beds in the plains, and, by altering the old courses, making them overflow the lands on either bank.

These extensive landslips are certainly taking place, and causing very considerable damage to low-lying tea-gardens, but the cause is not cultivation, but the excessive rainfall, which is literally washing away these hills, composed as they are of very soft strata, much shattered and

faulted. The worst damage was being caused in most places in the valleys which did not run far into the hills, and in which there were no settlers or cultivation. I also found much excellent land suitable for the cultivation of tea, which would benefit the Bhutan Government to a very large extent were they to allow European capital into the country for the purpose. There are magnificent forests also in this part of Bhutan, but the difficulty of transport would prevent their ever being a source of revenue to the State. I also found a considerable amount of coal in the lower hills, but it was of an indifferent quality and very much crushed.

From Dorunga I travelled with Sir Ugyen, and we went a short way up the Kuru river. Our first day's march took us through a very narrow gorge with perpendicular quartzite rocks on either side, and a hard climb brought us to the top of the pass, where we stayed for the night. The next day we dropped down into the valley, and after two days' march, came to the Dongma-chhu. It is difficult to judge of the relative size of the two rivers, the Dongma and Kuru, without scientific observation, but I am inclined to think that this branch of the Monass, the Dongma, is as large, if not larger, than the Kuru or Lobrak. I saw both rivers on this journey in the cold weather, when the water was at its lowest, and I again saw them on my fourth journey, in the rains, when they were very much swollen, and I was therefore able to judge fairly well. After crossing the Dongma-chhu, the surrounding rocks changed to manganese limestone, and the vegetation lost all its sub-tropical luxuriance, and was chiefly *Pinus longifolium*, of which there were some magnificent forests. On the outer slopes of the hills there is hardly a habitation, but on coming into the Kuru Dongma-chhu river-basin villages became more plentiful, and there was a considerable amount of cultivation. The houses were well built, and the people looked prosperous and contented. My return journey was made by a slightly different route, which brought me out at Dewangiri.

I started on my fourth journey in May, 1907, in the middle of the hot weather, and until I reached Dewangiri the heat was excessive. The track leading from the plains to Dewangiri passes through narrow ravines in the sandstone hills, and a sudden thunderstorm coming on, I was nearly washed away with my baggage. The river rose with extraordinary rapidity. On leaving Dewangiri I followed Pemberton's route *viâ* Tashigong to Naylamdang opposite Lhuntsi Jong, but from thence I turned to the north, following up a tributary of the Kuru river. I was unable to follow the Kuru itself owing to the lateness of the season, for the river was already in flood and had washed away all the temporary bridges thrown across it to make a cold-weather road along its banks.

My route took me past Singhi Jong and over the Bod-la into Tibet. The road is fair all the way to Singhi Jong, and I was able to ride

most of it; but soon after leaving Singhi I had to abandon my mules and walk, and transfer my baggage to coolies, as the track crosses some magnificent but almost impassable rocks. The views near the pass were fine, but the weather was very wet for the most part, though in crossing the pass I left the rain behind me and had magnificent weather. The scenery also changed, becoming more rugged and barren, though some of the slopes were still well wooded. On descending the valley I soon realized I had entered Tibet, as the mountains opposite on the other side of the eastern branch of the Lobrak had not a tree or, to all appearance, a blade of grass on them, owing to the monsoon current having been stopped by the southern watershed of the great Himalayan range. I camped at Lhakhang Jong, where the Tibetan officials did all in their power to make me comfortable, and where Sir Ugyen met me. From Lhakhang my journey took me entirely through Tibet, and hence does not come within the scope of this paper, and I will only add that I went as far as the head of the Lobrak Chhu, crossed into the Chomo-Chang-tang lake-basin, and thence into the Neylung valley and on to Gyantsi, from whence I returned by the ordinary route *viâ* Kala Tsho and Phari.

My fifth journey took me practically over the same ground as in my second journey, with the exception that on this occasion I entered Bhutan from Phari *viâ* the Temola, following the route *viâ* Duggye Jong, and returned to the plains from Paro by a hitherto unknown route *viâ* Bite Jong and Dongma Jong, entering the plains at Jaigaon. This journey calls for no special mention, and as my paper is already a very lengthy one, I will pass it over with the remark that on the journey from Paro southwards I passed some magnificent forests of pine of all kinds, and on the outer slopes of fine oaks and chestnuts, which ought in the near future to be of value to the Bhutan Government, and which I have advised them to conserve most carefully, as they are within carrying distance of the large tea districts in the Doars and the prospective tea industry along the Bhutan subhills, where there are most valuable tea lands, regarding which the Bhutan Government is at present negotiating with the British Government.

I hope I have said enough to show what an exceedingly interesting and beautiful country Bhutan is, and hope that under Sir Ugyen's rule it will soon be opened up and become a prosperous and enlightened State.

Geographical Position.—Bhutan is bounded on the south by Assam, on the east by the state of Towang, subject to Tibet, on the north by Tibet, and on the west by Sikkim and the British district of Darjeeling. It lies entirely within the Himalayas, between 26° 30′ and 28° 30′ N. lat. and 88° 45′ and 92° 15′ E. long.

Mountain System.—The mountain system may be most easily described as a series of parallel ranges running, in a more or less southerly

direction, from the main ridge of the Himalayas, where they attain an altitude of from 24,000 feet to 25,000 feet.

River System.—The drainage runs from north to south, following the mountain system. The main rivers are—

(1) The Ammo-chhu, known as the Torsa in the plains, which takes its rise in the western slopes of Chomolhari, and drains the Chumbi valley.

(2) The Wang-chhu or Tchin-chhu, known as the Raydak in the plains; its main tributaries are the Ha-chhu and Par-chhu, as well as many small rivers.

(3) The Mo-chhu or Poonakha-chhu, which becomes the Gadadhar in the plains. Its main tributaries are the Tang-chhu, Po-chhu, and Mo-chhu, and it drains a very large area, some of its tributaries taking their rise on the south side of the Wagya-la, at the head of the Neylung valley.

(4) The Karu-chhu or Lobrak-chhu, known in the plains as the Monass. This river, as well as its large tributary the Gongmachhu, takes its rise in Tibet on the northern slopes of Kulu Kangri, and in a snow range to the east of Towang. It has several other large tributaries, amongst them the Pumthang-chhu and the Mati-chhu. The Monass drains the whole of eastern Bhutan, and has cut a deep gorge from its source to its inlet in the plains, passing through the main range at an elevation of 10,000 feet.

General Division of Country.—Bhutan may be roughly described as consisting of three distinct zones rising one above another.

1. The outer hills, which rise abruptly from the plains of Bengal to a height of between 3000 to 4000 feet.

2. The central temperate valleys, running up to a height of 9000 feet.

3. The high grazing-lands and snowy ranges.

1. The first zone is about 30 to 40 miles wide, where the rivers run with great swiftness through deep-cut ravines. The rainfall varies from moderate to excessive, and the vegetation is luxuriant. Owing to the prevalence of fever, habitations are few and far between, tenanted principally by Bhutanese bearing a bad character, and by Paharias, who have migrated from Nepal along the foothills. The climate is indifferent, but on the uplands of Sipchu in the west the Nepalese emigrants have cleared off the forests and are increasing rapidly, in a manner which shows that in their case they find nothing to complain of.

2. The central zone covers from 20 to 25 miles, and is a series of wide valleys parallel to each other, running in the same direction as the mountains. The slopes are not nearly so precipitous as in the outer hills, and, owing to a more moderate rainfall and cooler climate, are clothed with the vegetation of more temperate regions, such as firs, pines, junipers, oaks, etc. These valleys lie at elevations from 4000 feet to 9000 feet, and are sometimes over 2 miles wide, as at Paro and

Byagha. In my opinion, these flats appear to be beds of old moraines which have not yet been scoured out into the deep-cut V-shaped valleys which characterize the lower hills. The rivers, owing to their broader channels and diminished rainfall, are not so swift or so subject to floods, and in consequence the range of fluctuation in their levels does not exceed a few feet.

3. The third or northern and highest zone consists for the most part of narrow gorges opening out into wider valleys, hemmed in by high bare rugged mountains, and as the greater part of it lies above the limit of tree vegetation, it is but sparsely inhabited.

During the summer months, when the higher slopes are covered with luxuriant grass, a limited number of families, with their herds, which are not very numerous, consisting mostly of yaks, migrate to these uplands to take advantage of the splendid grazing. Sheep are conspicuous by their comparative rarity, but game is plentiful, Burhel, *Ovis Hodgsoni*, shau, and takin being found in these parts.

Climate and its Effect on Vegetation and Scenery.—Lying in the position it does, and with such differences in altitude, naturally the climate of Bhutan varies enormously, and with it the vegetation, which graduates from sub-tropical in the deep-cut lower valleys to arctic in the higher regions. Consequently the scenery is very varied and most beautiful. In the lower valleys, with the excessive rainfall and the hot moist atmosphere, the vegetation is luxuriant, palms, ferns, canes, and bamboos growing in wild profusion, changing gradually as one ascends to groves of chestnuts, oaks, alder, fir, magnolia, and birch, the highest of all birch and juniper, close to the snow-line. Between 4000 feet and 15,000 feet, the whole of the higher hills are clothed with most beautiful rhododendrons, of which there are no less than thirty-three known varieties, and which, flowering in masses, make a blaze of colour, while the magnolia blossoms stand out pure white and pink on the huge trees in the midst of dense forest. In the forests themselves, above 7000 feet and up to 10,000 feet, the trees are festooned with trailing masses of moss and grey lichen often 4 feet to 6 feet in length, and have every appearance of a fairy scene, more especially when after rain everything sparkles with dew-drops in the brilliant sunshine. At these high elevations, too, are the enormous pine forests into which the glaciers descend, and still higher, stretches of magnificent grazing-grounds studded with alpine flowers, surrounded by some of the finest snow-peaks in the world.

Every kind of scenery is to be found, from the lower valleys with masses of tropical vegetation growing in the soft damp atmosphere, full of brilliant soft colouring, with their great swift rivers running past, and glimpses of the distant snows, to the higher valleys and mountains with more temperate vegetation, their forests, and crags, with mountain torrents rushing through narrow gorges and wonderful waterfalls, and

wider views of the snowy mountains, still with the peculiar softness due to the damp atmosphere; and, highest of all, magnificent snow-peaks and glaciers standing out sharp against the sky or shrouded in cloud and mist, grim and forbidding. It is impossible to find words to express the beauty of the scenery and its varied character, and I fear my lantern views do but bare justice to their subjects.

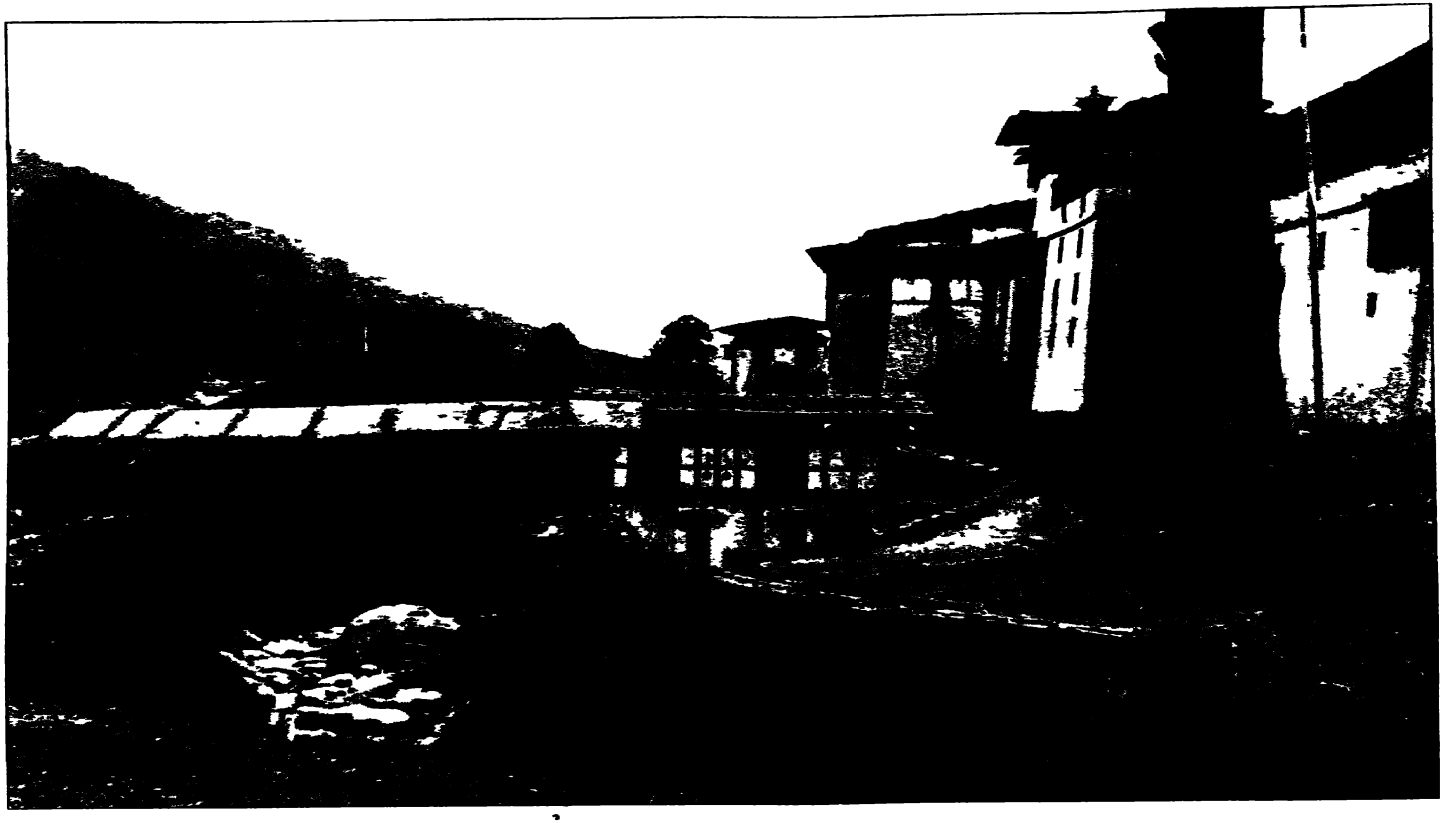
History.—To explain some terms in my lecture a very brief history of Bhutan seems necessary. In the eighth century of our era the country was inhabited by people closely connected with India, and governed by small princes, of whom the Sindu Raja was the most powerful. This monarch, with his subjects, was converted to Buddhism by the Indian Saint Padma Sambhava some time prior to the saint's visit to Lhasa. The kingdom, however, was overthrown in the latter part of the ninth century by Lan-darma, the apostate King of Tibet; and again two centuries later the country was overrun by people from the north of the Himalayas; but no one appears to have had any authority, until we find in the thirteenth century a powerful lama, styled Lapha, who in his turn was ousted by Lama Fago Dukgom-Shig-po of Ralong, with whom came five lamas belonging to rival sects. I mention this, because Lama Apha, after his defeat, handed over the Chumbi valley, hitherto Bhutanese, to the ruler of Tibet. In 1557 A.D., another Ralong monk, Dujom Dorji, entered Bhutan, and after continuous warring with the successors of the five lamas mentioned before, made himself master of the whole country; several invasions from Tibet were successfully repulsed, and his kingdom firmly established. He is best known by his title of Shab-dung Nawang-Namgyel-Rimpoche, or the Dharma Raja of Bhutan. He introduced good government, appointed local governors under the titles of Penlops, Jongpens, Zimpens, etc., and established a central council, with a deputy or Deb Raja as president, and to them entrusted the executive or civil administration, while he devoted the latter days of his life to religious duty. He died in 1592, aged fifty-eight.

After his death a triple reincarnation arose. His body reappeared as the Dharma Raja, his voice as the Chole Tulku, and his mind as Thi Rimpoche; and these incarnations have been continuous to the present time. The late Dharma Raja died some four years ago, and his successor has not yet been recognized, the late Deb Raja was the Chole Tulku, while the Thi Rimpoche has committed grievous sin and will not again appear.

The office of Deb Raja was an elective one, and lasted nearly 350 years; but on December 17, 1907, the lamas, officials, and laymen of Bhutan unanimously abolished the office, and proclaimed Sir Ugyen Wangchuk Maharaja or Gyelpo, and declared the office to be hereditary in his family. This was done with the consent and approval of the Deb Raja, who has now retired to a life of seclusion and religious meditation.



BRIDGE AT ANGDU PHODANG



TONGSA JONG.

The proximity of Bhutan to the route finally adopted for our military expedition to Lhasa in 1904 rendered the attitude of the Bhutanese Government toward us a matter of considerable importance. Fortunately, the Durbar decided to follow the precedent of 1888, and refused to join Tibet. They moreover sent the Tongsa Penlop, Ugyen Wangchuk, as their representative to accompany the mission, to give every assistance in his power. As a recognition of his valuable services, Ugyen Wangchuk was honoured by a Knight Commandership of the Indian Empire, and in March, 1905, I was despatched by the Government of India, at the head of a mission, to convey to Sir Ugyen the Insignia of the Order.

Our knowledge of Bhutan has been chiefly derived from the somewhat restricted reports of previous missions. Bogle in 1774, and Turner in 1783, entered the country from the plains of India at Buxa, Captain Pemberton with Dr. Griffiths at Dewangiri, while Eden crossed from Darjeeling *viâ* Dumsong and Sipchu in 1864. There was also the military expedition in 1864–5, which resulted in our seizure of the eighteen Docars and the Daling Subdivision territory, which has proved of enormous value to the Government of India, and which brings in a large revenue.

Ethnography.—It would be impossible to classify or trace the origin of the many different types of people found in Bhutan, without long and careful study, but I would point out that people from China, Ladakh, and Europe have found their way to Bhutan, as well as Khampas, Duphlas, and other nearer races. We came across two or three men who, in fairness and texture of skin and hair and in feature, were indistinguishable from English or Germans, while others were low animal-looking negroids; but among the better classes there certainly are three distinct types: first, one in which the men, like Sir Ugyen Wangchuk, have broad pleasing faces, somewhat French in character; second, a Semitic type, with features resembling those of Cabulis; and a third type, in which the facial characteristics are oval and refined.

A curious fact differentiates the Bhutanese from all their neighbours, viz. the hair on their faces. It may be noticed that the Dharma Raja is usually depicted with a long pointed beard, and many, like Sir Ugyen, wear moustaches.

Morals.—It is possible that eighteen years' freedom from internecine strife, and a firmer and juster administration, as well as a complete cessation of slavery, when the slaves were recruited from the scum of the plains, may have brought about a change in the moral qualities of the Bhutanese; but my experience in no way bears out Dr. Griffith's strictures that they were "immoral, indecent, dirty, wanting in courage, and given to drink; while the higher classes were utter strangers to truth, greedy beggars, rapacious, and crafty in working evil." I will not finish his remarks, as they are utterly inapplicable at the present

time. On the contrary, we were well received and welcomed everywhere. Nothing immoral or indecent ever came to the notice of myself or the members of my missions either time, or in any of my travels. The men are not nearly so dirty or offensive as they have been represented, nor do I consider them idle and drunken. Certainly they do drink much *chang*, but not so much as their Sikkim neighbours. Besides, the strength of *chang*, or *murwa*, is less than half of the mildest of ales, and it is impossible for even a weak-headed person to become at all elevated by drinking it.

On the outer hills bad characters undoubtedly swarm, and so acquire a bad reputation for the bulk of the people; but in so far as personal experience goes, I can hardly speak too highly or gratefully of the friendly reception I met with everywhere, the warmth of their welcome, and the desire of all classes to show me hospitality.

Physically, the Bhutanese are a fine, robust people, who compare very favourably with their neighbours in Sikkim, Tibet, and the plains. They are active and capable of enduring hardships; good walkers, and able to cover immense distances in their own hills. On the other hand, the Bhutanese are rather wanting in energy and initiative, and at the same time are inclined to bluster. Those who live in the intense cold of the higher altitudes, in tiny huts full of smoke, are dirty in person and habits; but we ourselves did not always insist on having a morning tub when at 13,000 feet. All the people who formed the immediate *entourage* of the officials were clean and respectable in their outward appearance, while the officials themselves were always immaculate in their brocades and silks.

It is impossible to estimate the population of Bhutan exactly, or even to decide whether the true Bhutanese race is diminishing; but there can be no question that the outer hills are being overwhelmed by a flood of Nepalese immigrants. The general appearance of the country, the evidences of the abandonment of houses and terraced fields, and the decay of irrigation channels, all show that there were more cultivators formerly, and that there is ample scope for regeneration and immigration. I can safely predict that a little assistance and encouragement from the Government of India, which has benefited so much by the annexation of the Bhutanese Duars, would secure a return of prosperity throughout the country, which at present probably includes a population of at least 300,000.

Religion.—The religion professed by the people of Bhutan is Buddhism or Lamaism, *i.e.* they follow the religion of Lhasa, and though they have their own particular saints, they look up to the Delai Lama as the head of their Church.

Industries.—In handicrafts the Bhutanese used to be exceedingly clever, but the increasing poverty of the state is producing its natural effect, and good workmen are becoming very scarce. Good specimens of

metalwork are still made for the monasteries, but the open work, so conspicuous on the older sword-handles and dagger-sheaths, has almost become a lost art, and the same may be said of the work in applique and embroidery. Casting of bells and other articles is still carried on at Paro and Tongsa and other large forts. Weaving is pretty general; the factories are maintained by the wealthier officials, and the weaving-room at Byagha was very noticeable. Cotton, wool, wild and domestic silk are all freely used, but, unfortunately, the introduction of aniline dyes has spoilt many patterns. Matwork is very good, the work in many of their baskets being so fine as to be watertight.

Sword-blades are much valued, and good ones are regarded as heir-looms, and handed down from father to son. These blades, by dint of continual heating in charcoal, have been made into excellent mild steel, and are kept beautifully bright and polished. Their price varies from £2 to £50, though to a casual observer one is just as good as another.

Wood-carving and painting are still in demand for the monasteries, and, though scarcer than formerly, show no signs of deterioration. Clay images and ordinary articles of domestic use are turned out, but the potter's art is at a low ebb.

As architects and builders, the Bhutanese are no mean workmen. The houses are either built of stone set in clay, or clay empese. Under the latter process, clay mixed with small stones is placed in a wooden frame or mould and trodden down until it is consolidated into a block; this, on exposure to air, quickly hardens, and in course of some years acquires nearly the solidity of stone. This preparation is used either in blocks made on the ground and employed like huge bricks, or in layers made on the actual wall. The outer side of the walls has a slight inward slope, but the inner side is perpendicular. The houses consist of three or four stories, with generally a balcony or two, and sliding shutters to let in light or keep out cold. No ironwork is used, the doors turning on wooden pivots. The frames, beams, etc., are all fitted together on the ground, before being set up in the building itself, and kept together with key-pegs. Timber being plentiful, the ceilings are supported on numerous heavy beams, and are well planked, the highest being always covered with a coating of pounded clay to help keep rain out. The roofs are gently inclined, and formed of pine shingles from 4 to 5 feet long, which are kept in place by heavy stones, as in Switzerland. There are no chimneys, and ladders take the place of staircases. In laying out buildings, set-squares and a skirret and line are used. Wedges and heat are employed in splitting the stone slabs (many of which are of great size) used in paving the courtyards.

The cantilever bridges are very strongly made, and some are as much as 170 feet in span. The chains for suspension bridges are made of wrought-iron links, but of late years the construction of this kind of bridge seems to have been abandoned, whilst previously existing ones

have been allowed to rust and decay. I did not notice any cane suspension bridges such as are common in Sikkim.

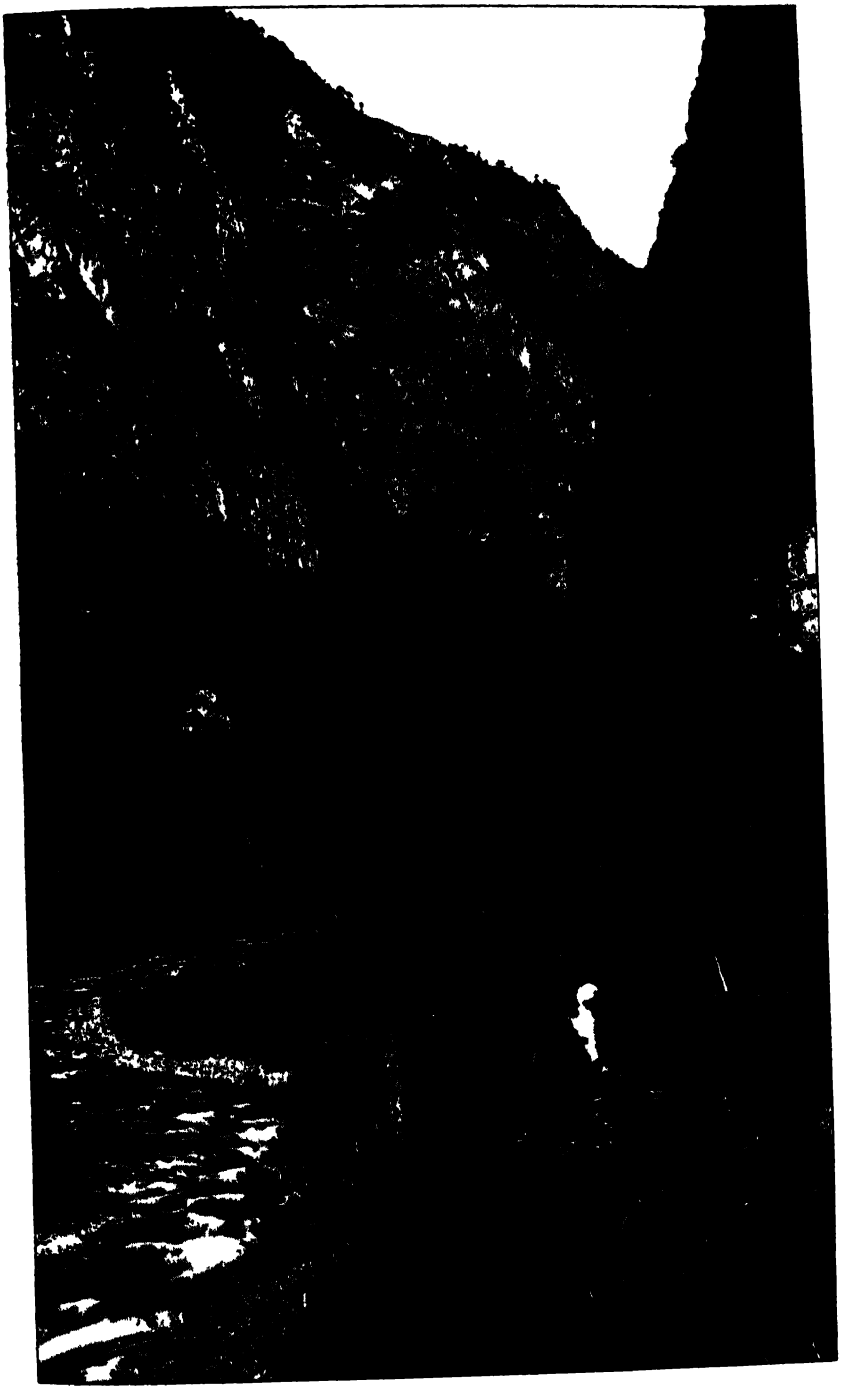
Geology.—I regret to say I know very little of geology, but, speaking generally, the extreme outhills are formed of soft sandstone, which contains veins or strata of coal. This series is the same as the Damuda series, and the coal is of the same formation. Where I have seen the coal, it is much crushed, has often been forced up by enormous pressure into lintel-shaped pockets, and is usually much faulted, and in many places inverted. The sandstone does not extend the whole way along the foothills, and has in several places been denuded.

Above these come mica-schists and quartzites. It is in the former that most of the minerals are found, but with the exception of copper, none have been found of any value. Iron is found in places, and is still worked by the Bhutanese. Above the quartzite magnesian limestone appears in several places, such as the Kuru river at Kenga, on the road to Tongsa from Dewangiri, and at Buxa. Above them comes gneiss, which forms the bulk of the rocks right up to the snows. This, however, is not invariable, as thick beds of limestone and shale are met with—limestone up the Tchinchhu, at Poonakha, Rokhbi, and in the Chumbi valley; and shale in the Tchinchhu and Chumbi valleys. Some of the very highest peaks are composed of granite, as the horn of Chumulhari. Beyond, *i.e.* to the north of the very highest peaks, come shale and limestone containing fossils. This tract is, however, in Tibet. A piece of gypsum was found in the river-bed close to the Dung-ma-chu.

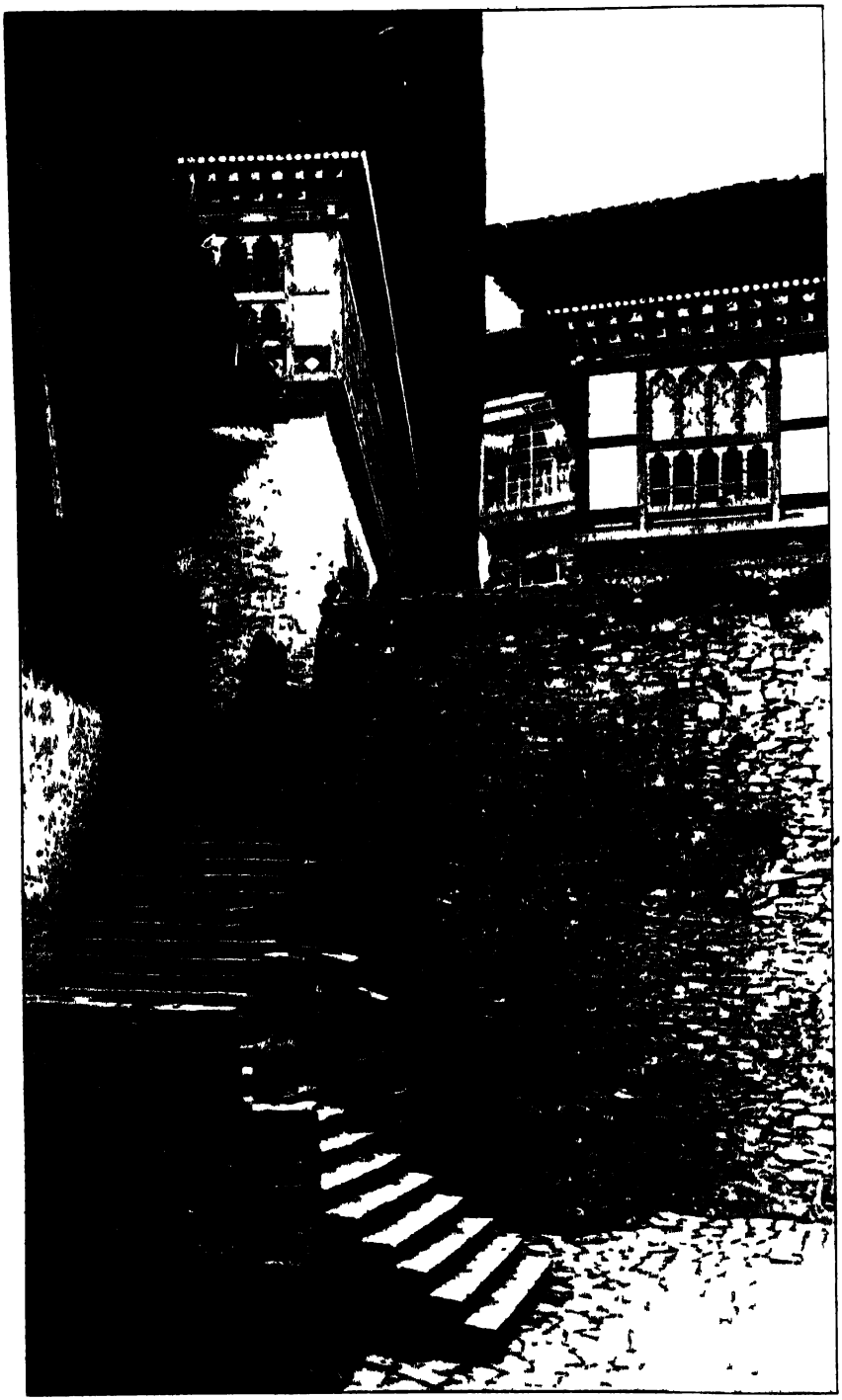
Botany.—We had a professional plant-collector with us, who succeeded in finding some 150 or 160 new species; the collection has not yet been systematically examined, so I cannot give any definite information as to the net result. This, however, is of little consequence in view of the magnificent collection made by Dr. Griffiths; and I can add nothing to Dr. Anderson's short note of 1865.

Zoology.—As regards animals, the habitat of the Takin (*Budorcas taxicolor Whitei*) was ascertained. Also news of several herds of shau does in the Chumbi valley was brought in, but none of stags, so they were left severely alone. Burhel were plentiful; in north-east Bhutan, *Ovis Hodgsoni* was common. Elephants were numerous in the outer hills, but most of the tusks we saw were said to have been obtained from elephants that had been dead for years. In the Tongsa Jurisdiction quail were very plentiful.

Among their domestic animals, the cross between the hill cattle and the wild mythun (*Bos frontalis*) is a very fine animal; the plough oxen in the Pumthang valley would earn a high place at our agricultural shows. So highly valued is this breed, that the Nepalese Government constantly send over to Bhutan for pure and half-bred mythun; a yearling calf which was offered to me was said to be worth at least £20 on the spot.



VALLEY ABOVE PASHI-CHO-JONG



INTERIOR, TONGSA JONG

Pigs also are good, English and China stock having been imported. Many of the fowls were fine birds, and pigeons swarm everywhere.

The once celebrated Tangun pony, mentioned by Turner and others, had entirely disappeared some twenty or more years ago; a mysterious disease broke out and swept the stock away. Mr. Paul seemed to have possessed one of the last; it was a very powerful skew-bald about 13 hands high at the outside, with a silky coat remarkable in a hill pony. At present the ponies are not equal to the mules, but Sir Ugyen has now imported an Australian stallion. The best mules, however, are brought from Tibet. Altogether horse-breeding is at a low ebb, as railways and cart-roads have put an end to the trade in ponies with the plains.

Revenue.—The second Deb Raja Migyur Tempa made a very good cadastral survey and record of rights, which is the basis of the present revenue system. The rent rolls are issued under the seal of the Deb Raja, and counter-sealed by the local Penlop or Jongpen. The position, size, and nature of each man's holding is carefully entered, and all increases or decreases, and any change of ownership, are noted under seal; the ryots only pay for what they actually possess; in consequence the state revenues vary, and are declining. The old village boundaries are still retained, and consist of natural features, such as rivers, streams, and ridges.

Agriculture.—Griffiths records, "Of the agriculture of Bhutan little is to be said, as so very large a proportion of the supplies is derived from the plains. The stage in which the little agriculture that is carried on is, argues as little in favour of the amount of agricultural skill they possess as the uncultivated state of the Duars does in favour of the numerical extent of their plains subjects." Probably the loss of these Duars has compelled the Bhutanese to pay more attention to agriculture. The Bhutanese cultivator lays out his fields in a series of really beautiful terraces, levelled from the side of the hill and often supported by strong revetments of stone, sometimes of considerable height. The fields are usually carefully protected either by stone walls or by fences of young pine trees and pine staves. In the main valleys further protection to the crops is afforded by planting rows of willows and other trees across the general direction of the violent winds which rush up from the plains.

To the excellence of their irrigation works I have already borne testimony. Both hoe and plough are used; the latter being larger and stronger than that of the plains. The principal crops are rice, wheat, barley, maize, buckwheat, turnips, and peas; as well as mustard and castor-oil seed and sugar-cane in small quantities. Oranges of excellent quality are grown on the outer hills, and very good walnuts are indigenous. Madder and rubber are not properly cultivated, but are found wild. Paper of very tough quality is made from the daphne plant,

which also grows wild. No attempt has been made to grow mulberry plants, because the cocoons, from which Endi or Erhi or Tussar silk is made, are collected in their wild state from the jungles inhabited by the insects which produce them.

The PRESIDENT (before the paper): Mr. White, who has kindly consented to lecture here to-night, is an engineer by profession, and, in the course of his professional duties, he has visited a great many parts of India. During the last twenty years he has been chiefly employed in Sikkim and in connection with the Tibetan border, and he has thus had the opportunity of making a number of interesting journeys into Bhutan, a region which is very little known. It is the results of those journeys which he is kindly going to describe to us to-night.

After the paper, Sir JAMES BOURDILLON: I was not aware that any discussion would take place, but I should like to say a few words which occur to me with reference to Mr. White's lecture. I wish first to draw attention to a matter which would certainly never have been mentioned by Mr. White himself, and that is the great debt we all owe to his untiring endeavours, and to his personal qualifications for carrying out the expedition he has described. He was stationed for a long time in the Eastern Himalayas, and gradually acquired a unique influence and authority among the people of those regions. Thus has grown up gradually, and by almost imperceptible degrees, the great power he displayed in carrying through this expedition. Bhutan, for a long time, has been an absolutely closed country to Europeans, and, if we look back to our official relations with that country, the review is one which cannot be regarded with satisfaction. Our envoys have been insulted, and our efforts towards friendship have been frustrated again and again; so that it is a most remarkable achievement on Mr. White's part that he has been able to carry out this expedition, and to turn what was a hostile foreign state into a neighbour closely allied in friendship with the Government of India. Mr. White has not been able, in the short time placed at his disposal this evening, to say much about the manufactures and the beautiful artistic work accomplished by the people. The Bhutanese have long enjoyed a very remarkable civilization. The metal work, the weaving, the embroidery, are all of the highest character, and not only very beautiful, but possessed of very distinct characteristics of their own. In conclusion, I will only ask you to express your satisfaction with the lecture we have heard to-night, and in doing so, never to forget how much is due to the great personal influence of Mr. White himself.

General Sir RONALD MACDONALD: My first acquaintance with Mr. White was just at the start of the Tibet Expedition. I had then the feeling that trusting to a single line was perhaps rather hazardous, and I asked Mr. White whether he could run an alternative line from Sikkim. He at once undertook to do so, and, thanks to his influence in Sikkim, he was able to put on something like 1500 men, who worked all through the winter and assisted our advance. When we got into the Chumbi valley in the winter, we very soon found that Mr. White had a great reputation among the Bhutanese, and when the Tongsa penlop, who is now the Maharajah Bhutan, came to visit us, he was already predisposed in Mr. White's favour; but this rapidly ripened into confidence and friendship, which has enabled Mr. White to achieve the great results of which we have just heard. We have heard how Mr. White was a welcome and honoured visitor in the exclusive country of Bhutan, and I will mention one little incident at Lhasa. When we arrived there, the Tibetan representatives asked us that we should prevent any of our officers or men entering any of their sacred places. After consulting Colonel Younghusband

I issued orders that all monasteries and temples were to be out of bounds. Then a message came in from the monasteries and chief Llamas to say that Mr. White was expressly excluded from this restriction, as he was welcome to visit their monasteries at any time, and they would be glad to see with him any officers for whom he vouched. While Younghusband and I were debarred from visiting any of these places, Mr. White was welcome.

Mr. A. W. PAUL: I may be permitted to add a few words to Mr. White's lecture, as I accompanied him in one of his journeys, and I would emphasize in particular the kindly way in which we were treated. I had some slight acquaintance with the Bhutanese before, because they were always having revolutions, and the unsuccessful always came to me, but even I did not realize their true worth When I went under Mr. White's auspices, I was practically a cripple. They understood that, and I was met by all sorts of contrivances to get me through without trouble. On the last pass I had two yaks, because they said the yaks were not in very good condition owing to the severe winter, and might get tired and jerk me; I had three mules—the very best, and, what was more than all this, five stalwart men. Mr. White only told you half the truth when he said that for dignity's sake he rode up from the river to the Tongsar fort. I can only tell you that not even his cook was able to ride down to the river. When I started I did not know what I was going to do, but I found *my* five men waiting for me, and they got me over that awful place in comparative comfort; it did not matter in the least bit where I was, I always had somebody to help me. I can only join with Mr. White in thanking them sincerely for all the kindness they have shown us. I quite endorse every word that has been said about Mr. White's influence and about the necessity of knowing more about Bhutan. The difficulty, even in recent years, of getting into touch with Bhutan and learning the true position of affairs there, was a cause both of anxiety and danger. Even as late as February, 1874, Mr. (Sir John) Edgar, then Deputy Commissioner of Darjeeling, wrote to me, "I have been thinking about that Bhutan business, and do not like it. I do not see clearly any danger on our side, but still one ought to make sure. Make private inquiries, but mind there is no fuss, for of course very little would make a panic, which of all things is to be avoided." It was essential to do everything possible to prevent a panic taking place amongst the coolies on the all-important tea districts lying at the foot of the Bhutanese hills.

It was a work of constant and unceasing anxiety to get into closer relations with Bhutan, all the more difficult because Government did not give us a free hand. But now Mr. White has changed all this, and the Bhutanese officials, so far from resenting interference, voluntarily petitioned Government to grant Mr. White extension of service that he might continue to help them.

Since Bhutan is so near the wealthy plains covered with tea gardens, it is absolutely necessary for the Government to encourage Mr. White's successor to continue amicable and sympathetic feeling and intercourse with the people of Bhutan, so that we may be confident that nothing will disturb the progress of the great tea industry. I am sure you will join in thanking Mr. White for having opened up a country which was described once as "hardly worthy of much consideration."

The PRESIDENT: In bringing the discussion to a close after the extremely interesting paper which Mr. White has been kind enough to read to us, I am speaking in the name of everybody here present when I say that the photographs have been ones of exceptional interest and exceptional beauty. I am very glad to hear what has been said by the various authorities here present of Mr. White's admirable work in Bhutan, and I am sure he deserves the greatest credit for what he has done in creating a spirit of friendship between the people of Bhutan and the

people of England. Mr. White tells me that he was able on one or two occasions to do a certain amount of surveying. It is often impossible for the head of an expedition to spend very much time in surveying operations, and I cannot help feeling it is a pity that the Government of India does not send a trained surveyor with all such expeditions. If this had been done we should now know far more about the detailed geography of Bhutan. The Government and people of this country are very apt to cry out for the want of maps. But if such steps were taken in advance, then the information would be at hand when wanted. I have merely to add that we always have an exhibition of objects of interest from the country about which the paper deals, and that on this occasion it is one of exceptional interest.

THE DEVELOPMENT OF WHEAT CULTURE IN NORTH AMERICA.*

By ALBERT PERRY BRIGHAM.

In the year 1602, on one of the Elizabeth islands off the present coast of Massachusetts, Bartholomew Gosnold made trial plantings of wheat and other grains. The Spaniards had earlier brought wheat to Mexico, but this was probably the first wheat sown within the boundaries of the United States. Nearly twenty years later wheat was sown at Plymouth, without success the first season, but with returns afterward. The grain extended itself among the New England colonies, and about 1700 there are records of shipments, as from Norwalk to Boston and Boston to Virginia. As the eighteenth century progressed, however, wheat declined, except as sown on fresh clearings, and was brought in from New York and the southern colonies. That wheat was already moving westward is shown by the fact that New England traders bought New York wheat, ground it in their own mills, and sold it in the West Indies. To revive wheat culture, Massachusetts laid a duty on the product to be paid as a bounty to farmers, but Weeden tersely says that "the duty could not counteract climate and soil nor feed the fishermen."

There is early record of wheat in Virginia, for in 1607 the Council informed the Council in England that they had fortified themselves against Indians and had "sown good store of wheat." The first sowings of English seed at Jamestown seem not to have been very successful. By 1800 wheat was raised along the entire Atlantic border except the southern parts of the coastal plain, but the middle states from New York to Virginia assumed pre-eminence and held the centre of wheat for more than a generation. Meantime, in 1769, missionaries carried the grain to California. There was important export to the West Indies in the early years of the Federal government, until Great Britain shut out the ships of the United States from this trade. In 1787 wheat was among American exports to Mauritius. But it was long before the United States was to assume a commanding position as a purveyor of bread, for in the decade 1830–1840 she imported several million bushels of wheat to feed her own population.

In the later years of the eighteenth century and the first decades of the nineteenth, western New York, or the Genesee country, proved its suitability in soil and climate for the growing of winter wheat. On the completion of the Erie canal in 1825, the industry was favoured by increased prices; the region was the famous wheat centre of the country, and Rochester was relatively as important for primary market

---

* Read at a joint meeting of the Sections of Geography, Agriculture, and Economics, British Association, Winnipeg, August, 1909.

facilities and milling as Minneapolis is to-day. The primacy of western New York was held until wheat began strongly to occupy the states north of the Ohio river.

Before tracing the westward march of the wheat centre it will be useful to survey the expansion of acreage and production during recent decades, or since 1866. It is this period of progress which has more than historical interest, since it has to do with any forecast of the future. From 1866 to 1875 the acreage in the United States varied between 15 and 26 millions, and there was a consistent rise from the beginning to the end of the decade. In the following ten years, to 1885, the range was from 26 to 39 million acres, giving on the whole a steady increase, but showing 34 million acres in 1885. The period 1886–1895 ranged from 34 to 39 million, with smaller acreage in the later years. From 1896 to 1905, the minimum was 34 and the maximum 49 million, but from 1898 to the present time the limits have been 42 and 49 million acres. The highest figure, 49 million acres, has been reached twice, in 1901 and 1903, and the significant element in the figures is the high average of the last dozen years.

Turning to production, the total for 1866 in the United States was 151 million bushels. In the next year, 1867, production passed the 200 million mark permanently. Another milestone was passed in 1873 with 308 millions. In 1878, the crop was 420 millions, and in 1882, 504 millions. There were fluctuations in the following years, for production from 1883 to 1890 only once reached the 500 million mark; but 1891 made a showing of 611 millions, and 1898 brought 675 million bushels. The average from 1898 to 1908 has been 643 million bushels, and the maximum was in 1901, 748 million bushels.

If single states be considered, some curious fluctuations are observable. Thus Kansas has never attained even fourth place in a census year, yet holds the state record, with her crop of 99 million bushels in 1901. She has at least four times passed Minnesota's record of 80 million bushels. Minnesota dropped from 68 millions in 1899 to 51 millions in 1900, and leaped to 80 millions in 1901. North Dakota in the same years went from 51 to 13, and back to 49 million. Kansas in those years made a steady gain from 35 to 82 and 99 millions. Production is so widely distributed, however, that the general total for the country is much more stable.

For an orderly review of the movement of wheat from east to west in the United States four regions may be distinguished as follows: (1) the middle Atlantic States from New York to Virginia, including especially Pennsylvania and Maryland; (2) the five states of the "Old North-west," lying between the Ohio river and the Great lakes; (3) seven states west of the Mississippi river, including Missouri and Kansas on the south and Minnesota and North Dakota on the north, the wheat belt reaching to the arid parts of the Great plains; (4) the Cordilleran region extending to the Pacific coast.

The first of these regions was the North American centre of wheat from the first full establishment of the crop in the colonies until the Erie canal and other means of communication opened to the east the possibilities of the old North-west. The crops of New York for eight census years are as follows. The crop of 1908 is also included :—

1839	12,286,418	bushels.
1849	13,121,498	„
1859	8,661,106	„
1869	9,750,000	„
1879	10,746,000	„
1889	8,929,000	„
1899	7,005,765	„
1908	7,752,000	„

The crop of 1905 rose above 10,000,000 bushels. Pennsylvania has had a fairly steady rise from 13,000,000 bushels in 1839 to 24,000,000 in 1899, and her crop for 1908 was 29,000,000, ranking this state among great producers—a fact not often recognized. Maryland has almost trebled since 1869, and has been above the ten million mark since 1897, producing nearly 15,000,000 bushels in 1907. Virginia fluctuates, usually producing from 6 to 10 million bushels. Even West Virginia, North Carolina, and Georgia show fairly steady records of several million bushels each. Taking those states which border the Atlantic, not including the gulf, the total production of wheat in 1906 was 76 million bushels. In production per square mile Maryland held third place in the census of 1900 and in that of 1890, and her crop per capita in 1907 was more than 11 bushels. New York's production averages about 1 bushel per capita, and Pennsylvania's rate in her best years is about 4 bushels.

These figures concerning the sustained yield of many states on the eastern border have been given to show that the decline in wheat culture in this region is largely relative rather than absolute, a fact with which common impressions are at variance. It is true that as a whole the needs of the local population are not met, and that here is a large market for western wheat, but it is not true that the soils are exhausted, or that the Atlantic belt of states fails, or will ever fail, to make a substantial contribution to the bread supply of the nation. New England's contribution was never of great significance, but it is of interest to note that in recent years Maine and Vermont are the only states in that group which make a report of this cereal.

Before passing to the remaining major regions, it will be of interest to show in the following table the rank of leading states in census years since 1839:—

RANK OF LEADING STATES FROM THE SIXTH TO THE TWELFTH CENSUS.

Year	First	Second	Third.	Fourth	Production of first state.
1839	Ohio	Pennsylvania	New York	Wyoming	16,000,000 bush.
1849	Pennsylvania	Ohio	New York	Virginia	15,000,000 „
1859	Illinois	Indiana	Wisconsin	Ohio	23,000,000 „
1869	Illinois	Iowa	Ohio	Indiana	39,000,000 „
1879	Illinois	Indiana	Ohio	California	44,000,000 „
1889	Minnesota	California.	Dakota	Indiana	45,000,000 „
1899	Minnesota	N Dakota	S. Dakota	Ohio	68,000,000 „

The swift progress of wheat westward is well shown in the fact that Illinois, which is not named in 1849, takes first place in 1859. In the same sudden manner Iowa springs to second place in 1869, and Minnesota to first rank in 1889. It will be remarked that Ohio persistently keeps its place within the group of four for every census except one, and that is not the last one. In the same connection it should be observed that a state lying farther west, Illinois, after holding the primacy three times, passes at once out of the leading group. It has already been stated that banner state-yields seem to avoid census years, for Illinois has a record of 60 million bushels in 1880, Minnesota has risen to 78, 79, and 80 millions, North Dakota to 75 and 77 millions, and Kansas leads all, producing in 1901, 99,079,304 bushels.

In 1839, while New York and Pennsylvania stood at 12 and 13 millions, Ohio had come to the front with 16 million bushels, and the great record of the second region was well begun. In forty-one years, from 1866 to 1906, Ohio produced 1,247,082,674 bushels, an average of 30,416,650 bushels. In the twenty-year period, 1867–1886, the total falls more than 100 millions short of the total for the following equal period, 1887–1906. This is a most significant showing, and it should be added that among all states, Ohio in the twelfth census, crop of 1899,

stood first among all states in product per square mile. Thus still further emphasis appears as to the importance of wheat grown east of the Mississippi river. Ohio has eight times exceeded 40,000,000 bushels.

The facts for Indiana are of similar magnitude. In 1860 she was second in production per square mile, was first in 1870, 1880, and 1890, and fourth in 1900. Her total for forty-one years, 1866–1906, fell little short of Ohio, and she raised nearly 100,000,000 more in the second twenty-year period than the first. Like Ohio, Indiana exceeded 40,000,000 eight times in the period named, and raised more than 45,000,000 in 1908. Illinois has a total for forty-one years just under that of Indiana, being 1,160,352,208, an average of 28,301,273 bushels. In this state a balance of about 100,000,000 bushels is in favour of the first twenty-year period. While Ohio and Indiana contain only minor areas of prairie, Illinois is a typical prairie state and goes heavily into the production of maize, in which it more than equals the combined crops of Indiana and Ohio.

Michigan and Wisconsin, the lake states of this group, make a lesser showing in wheat, Michigan having produced in forty-one years two-thirds as much as any one of the three Ohio river states. The second twenty-year period shows a moderate decline over the first. In 1908, however, Michigan raised nearly 16,000,000 bushels, a product of no mean order. Her maximum of 34,000,000 in 1898 suggests what her possibilities are. Wisconsin has a different record, having often produced over 20,000,000 until 1884, and since 1892 has but three times reached 10,000,000. In 1908 she dropped to 3,328,000 bushels. This does not mean that this great state is unsuited to wheat. The crop suffered decadence through soil exhaustion, insect enemies, and the vast growth of dairying; but with intelligent methods there seems to be no reason why Wisconsin may not again stand well up in the wheat column. Mr. R. A. Moore, Agronomist of the College of Agriculture at the University of Wisconsin, expresses the opinion * that "the pendulum will swing back to quite an extent." He thinks the land of Wisconsin too rich for oat-raising, and that with rotation and other modern methods wheat can again be raised without impoverishing the soil. Before leaving the second group of states it will be of interest to note that of the entire crop of 1906, in the United States, or 735,000,000 bushels, 250,000,000 were grown east of the Mississippi river. This amounts to about 34 per cent., or slightly above one-third of the total. The third group of states forms the well-known present centre of wheat in the United States, and the figures need not be given in detail for individual states. Minnesota produced 10,000,000 bushels in 1867, and has steadily risen, until, since 1895, her crop has never been less than 46,000,000 bushels, and has ranged up to 80,000,000. Iowa as a praire state most resembles Illinois, but her wheat has seen larger decline. Thirty years ago the crop often passed 30,000,000 bushels, but in recent years runs from 8 to 14 millions. The reason is doubtless to be found in the expansion of maize and live stock industries. Her average for forty-one years, 1866–1906, was 21,432,000 bushels. Missouri holds a strong average production in recent years, of 20 to 30 million bushels, the maximum being 56,000,000 in 1902.

Kansas, Nebraska, and the two Dakotas may be called the Missouri river wheat states, and represent the newest and greatest development of wheat within the territory of the Republic. In 1882 Dakota territory (before division) reported 11,000,000 bushels. This was but twenty-seven years before the present writing. Since 1897 the crop of North Dakota alone has but once fallen below 51,000,000 bushels, and rose in 1905 and 1906 to 75 and 77 millions. Nebraska's product is usually above 40,000,000 bushels. The total of the three leading wheat states of the present time is as follows for the ten years 1897 to 1906:—

* Letter of March 16, 1909.

Minnesota	685,129,558	bushels
North Dakota	533,777,567	„
Kansas	687,901,805	„
Total	1,906,808,930	„

Kansas has a slight lead over Minnesota. She has had several greater crops than her rival, but is subject to greater fluctuation. The average annual total for these three states 1897–1906 was 190,000,000 bushels. The states of Oklahoma and Texas represent an extension of this belt along the more southern parts of the prairies and great plains. Oklahoma has a record in 1894 of 2 million bushels, with a fluctuating rise to 18 and 15 millions in 1906 and 1908. The crop is, of course, of longer standing in Texas, with report of nearly 2 million bushels in 1866, to a recent average of about 12 millions. It is an important fact that this belt with its wide range of latitude divides itself into a spring wheat region embracing the five states Iowa, Nebraska, Minnesota, and the Dakotas, and a winter wheat section to the southward. In like manner, Wisconsin and Washington, in the second and fourth of our major regions, raise spring wheat.

The Cordilleran region offers an older development of wheat in the three Pacific states, and a more recent progress in the intervening regions of the Rocky mountain plateaus and Great Basin. This is in harmony with the extraordinary leap of the frontier a half-century ago, followed by the gradual occupation of intervening territory.

California reported 12 million bushels so long ago as 1868. Her maximum crop of 45 million bushels belongs to the year 1896. A comparison of two twenty-year periods, 1868–1887 and 1888–1907, shows but slight decline; but if two ten-year periods, 1888–1897 and 1898–1907 be taken, there is an important falling off, due perhaps to the immense advance of horticulture and the progress of irrigation. California produced in thirty-nine years, 1149 million bushels of wheat. Oregon has had a somewhat uniform range of 10 to 16 million bushels since 1880, rising to 24 million in 1898. Not quite 11 million bushels were produced in 1908. Washington, on the other hand, has seen conspicuous progress, and since 1897 has ranged between 20 and 34 million bushels. The greatest thousand-acre yield ever reported is ascribed to eastern Washington in 1881, viz. 51,000 bushels.*

Outside of the coast states there are no large producers in the Cordilleran region. Idaho, Colorado, Utah, and Montana each grow several million bushels per annum, but in a general survey their chief interest has to do with their future possibilities under irrigation. The Cordilleran total for 1906 was 94,111,584 bushels. This is 18 million bushels more than was grown in the Atlantic coast states in the same year, but the western area is several times greater.

The following table, from the Twelfth Census, gives the successive positions of the wheat centre of the United States for the half-century, 1850–1900.

WHEAT CENTRE, U.S. 1850–1900 (SECONDS OMITTED).

Census year.	N. lat.	W. long.	Approximate location by important towns.
1900	41° 39′	94° 59′	70 miles west of Des Moines, Ia.
1890	39° 33′	93° 9′	138 miles south by east of Des Moines (in Mo.).
1880	40° 36′	90° 30′	69 miles north-west of Springfield, Ill.
1870	40° 39′	88° 48′	82 miles north-east of „ „
1860	39° 59′	86° 1′	18 miles north by east of Indianapolis, Ind.
1850	40° 14′	81° 58′	57 miles east-north-east of Columbus, O.

* 'Rep. Bureau of Statistics, Washington, 1903,' p. 69.

An examination of this movement brings out some interesting facts. The amount of westward migration in fifty years was 680 miles. The northward movement was about 99 miles. The latitude variation was marked by slight fluctuations for forty years, and then in a single decade wheat moved more than 2° northward, owing to rapid increase in the north-west. The greatest westward movement was in the first decade, 1850–1860, amounting to more than 200 miles. The westward movement in the ten years 1890–1900 was a little less than 100 miles.

At the last census the centre of population was in south central Indiana; the centre of manufacture was in central Ohio; of corn, in Western Illinois, between Springfield and St. Louis; of all cereals, on the Mississippi river near Keokuk, Iowa; and the centre of wheat was in Western Iowa. In 1850 the corn and wheat centres were near each other in Ohio. Wheat has outrun all the other great interests in its westward march.

The present position of the centre of wheat raises a most interesting inquiry. The latest data are for 1908, and returns for a few minor states are not before the writer. For exact determination, detailed figures for counties are used by the Census Bureau. But taking the state totals, it appears that 320 million bushels approximately were raised in the states east of the Mississippi, plus the tier of states bordering the west branch of that river. This is a little less than half the crop, and would seem to carry the centre for 1908 out of Iowa and across the Missouri river. Considering latitude movement, it must be noted that California has fallen off, but this is partly offset by a decreased crop also in Oregon. The crops, however, of Kansas, Missouri, Illinois, and Indiana, which are mostly south of the centre of 1899, were much greater, in relation to the total, in 1908 than in 1899. It would seem clear, therefore, that for 1908 the centre has returned southward, and might probably be found in south-eastern Nebraska.

Passing to the inquiry as to the centre of wheat in North America, it is to be observed that the Canadian crop of 1908 * was 112,434,000 bushels.

To take this into account would move the centre as determined for the United States northward, across a belt sufficient to raise half the Canadian product, or 56 million bushels. Assuming the centre for the States as in south-eastern Nebraska in 1908, this belt would cross Southern Iowa, and the northern part of Illinois, Indiana, Ohio, and Pennsylvania. As these states are heavy growers, the belt would be narrow, and the centre for North America would not go higher in latitude than that for the States in 1899.

The greater part of Canadian wheat, about 92 out of 112 million bushels in 1908, is raised in the western provinces, and therefore westward of the centre for the States. Making allowance in a similar manner, the longitude centre for North America would be found by passing westward across a section of Dakotas, Nebraska, Kansas, and Oklahoma, and would probably lie in Nebraska, 100 miles or less westward from Omaha. This is more than 500 miles from the Canadian border, and the Dominion's production must vastly increase before the 49th parallel will be approached.

The importance of the new development in the north is not, however, thus measured. It is easy to conceive of a time in no distant future when the United States might raise 800 million bushels, and consume 700 million, while Canada might at the same time raise 400 million and consume 100 million bushels. The northern country would even then hold a threefold more important place in the public markets of the world than her neighbour, even while the North American centre of production remained at some distance south of the international boundary.

---

* *Census and Statistics Monthly.* Ottawa: December, 1908.

The movement of wheat-growing has been from east to west, and will now be from south to north. This is largely the movement of history, and follows the migration of the frontier in our continent. The direction has thus had a historical origin, and both the direction and the rate of movement have been conditioned by the development of transportation. The more special and local reasons for the shifting of wheat lend themselves to inquiry, and have perhaps been nowhere else so well discussed as by Mr. C. W. Thompson.* The subject of study is the shifting of wheat-culture in Minnesota. This cereal has gone from south-east to north-west in the state. Olmstead county, in the south-east, is as fertile and as capable of large crops of wheat as the best Red river lands, and is as good now as it was in 1870. The one region is as favourable in soil and climate and as suited for the use of machinery as the other. But as population increases and land grows in value, more must be allowed for rental, or interest on investment, and intensive, diversified farming replaces the more extensive wheat farming. The bonanza wheat farms tend to break up as the population grows, for with skinning processes, and much hired help in one part of the year, and, it may well be added, with no stock or rotation of crops, there is no way to enrich the land, to cultivate thoroughly, and thus increase the product of an acre. The acre must be put to crops and tillage that will enable it to bear its greater burden, and wheat must go elsewhere. Moreover, the best returns accrue where one man, the owner, and one set of farm machinery, do most of the work. Such farms contain from 160 to 170 acres of land. Hence, not only does diversified farming drive out wheat in some measure, but the smaller wheat farm drives out the great bonanza farm with its thousands of acres, its enormous machines, and its small army of labourers.

It is, therefore, an error to think that wheat must pass or be in jeopardy with the elimination of the frontier. This has already been seen in the sustained wheat-growth of the North-West. In the census year, 1899, more wheat was raised on farms of 101–175 acres than on those of any other specified size. Less than one-eleventh of the country's wheat grew on farms exceeding 1000 acres. Almost one-fifth was raised on farms of less than 100 acres. Taking the whole country, the yield per acre on the smaller farms was slightly greater than the yield on the large farms, notwithstanding the fact that the latter were chiefly areas of virgin soil. Thus, while wheat has figured largely as a pioneer crop, to be grown on free or cheap land, these conditions are not so important as is supposed, and an old, highly cultivated country like France, raising nearly all its own wheat, offers the best of object lessons. Dondlinger,† while holding that much land will become too valuable for wheat, thinks that lands now idle will be brought to its production, and even anticipates that the centre of wheat-growing may reverse its historic direction of movement and return eastward.

In 1904, Dr. William Saunders reported that Fort Simpson on the Mackenzie river was the most northerly point from which samples of wheat had been received. This is about 62° N. lat. Dondlinger‡ is authority for the statement that spring wheat has been matured at Rampart and Dawson, still nearer the Arctic circle. It is fair to say, however, that the latitude range of wheat in North America is from 30°, latitude of New Orleans, 60°, latitude of the northern boundary of Saskatchewan and Alberta, a belt of 30°. The areas of large and assured production may, however, always remain between 35° and 55°, with more chance for northern than

* *Quart. Journal of Econ.*, vol. 18, 1904, p. 570.
† 'Book of Wheat,' p. 303.
‡ *Ibid.*, p. 5.

southern expansion. In Eurasia, wheat reaches to Trondjhem (63½°) and northern Russia, and to a point in India below the Tropic of Cancer (21°). This greater range of 40° is due to the cooling effects of the altitude of the high slopes and plateaus of Northern India. By including the product of Mexico and the Central American states, though small, the North American range may also be greatly extended. Thus from Nicaragua to the Mackenzie river wheat reaches across 50° of latitude.

Wheat is so important that every effort will be made to widen its areal and its latitude range. This will be accomplished in part by irrigation. In the last census year, 1899, 99 per cent. of Arizona wheat was irrigated. This territory is a small producer, but Colorado and Utah, much larger growers, watered 84 and 57·4 per cent. respectively of wheat lands. The three states of the Pacific coast, which are larger producers, irrigate but a small part of their wheat. In the year named, all the Cordilleran states, with Nebraska added, irrigated 14·1 per cent. of their wheatfields, and raised on this area 17·7 per cent. of their crop. This shows that the yield can be enlarged where wheat is already grown by dry farming, as well as by bringing new lands under the ditch. The cost of irrigation works, however, may make extensive wheat-growing impracticable, because other crops permit more intensive farming and offer larger returns. Our conclusions must be that only a moderate expansion of American wheat will be due to irrigation.

Agricultural exploration and the importation of varieties may be expected to show, and indeed are now showing, much greater results. Some time ago the Department of Agriculture brought from the Crimea and naturalized in Kansas a red winter wheat, which is described as high in hardness, yield, milling value, and in its resistance to disease. Various other Russian sorts have served to push the wheat areas westward into the vast semi-arid regions where water is too limited for extensive irrigation, and which, therefore, must be given over to pasturage unless the crops can be adjusted to small rainfall. These varieties belong to the durum, or so-called macaroni wheats, and are commonly raised not only in Russia, but in Turkestan, Algeria, and other parts of the world where the climate is dry and hot.

A climatic comparison of the Great Plains, which cannot grow the usual varieties beyond the one-hundredth meridian, shows that the American semi arid belt has 3 inches more rainfall than the great home of macaroni wheat on the plains of the Volga.* The author here referred to, also characterizes the soils of the plains as a counterpart of the "black earth" of Russia. The first introduction of Russian durum was made in the United States in 1864, and experimental proof of its value has become conclusive and final. The area suited to its growth extends in a wide north-and-south belt through the Dakotas, Kansas, Colorado, Oklahoma, and Texas. In 1906 the production of durum wheat in the United States had risen to 50,000,000 bushels, with a growing export demand in southern Europe as its qualities are known, and a larger domestic use accompanying development in milling methods and the enlarging of the macaroni industry.

Both yield and areal expansion have been assiduously promoted in North America by skilful selection and cross-breeding. Prof. W. M. Hayes estimates that farmers have increased the yield of maize 20 per cent. by selecting the best ears and they have also pushed the corn belt northwards.† According to the same writer, the past century saw the sugar content of the sugar beet doubled through selection by European seed-growers. Other important results from plant breeding and selection are familiar, and it has been shown by ample experience that no vegetable product

* 'Macaroni Wheats.' M. A. Charleton. Bull. No. 3, Bureau of Plant Industry, U.S. Dept. of Agriculture.

† Yearbook, U.S. Dept. of Agriculture, 1901. 218.

is more plastic than wheat. Different conditions in the United States have modified wheats in colour, hardness, moisture, gluten, and albumenoids, and have changed winter to spring, and spring to winter wheats. According to Hayes, a single variety known as Minnesota No. 169, bred at the experiment station, has raised the yield in that state no less than 5–10 per cent.

Among the most persistent and successful efforts in breeding new varieties are those carried out under the direction of Dr. William Saunders at the Central Experimental Farm, Ottawa, and at the other experiment stations of the Dominion of Canada. This work has peculiar interest, because one of the chief aims is to breed wheat suited to northern conditions. Where vast areas are suited to wheat in surface, soil, and potential transportation, it is of the utmost importance to secure early ripening and conformity to the shortness of the summer season. At the same time high quality must be preserved, since the chief present value of the crop is for the purposes of export.

The most important of these new varieties are the Preston, Stanley, Huron, and Percy.* Preston is named by Dr. Saunders as the best known of the early wheats, and the four named were all originated at Ottawa in 1888, by crossing Red or White Fife with Ladoga.† As compared with the old and standard Red Fife, these varieties all ripen four to twelve days earlier. Their yield, colour of flour, baking strength, and market value are all high, and the early ripening therefore extends the wheat belt northward to a significant degree. The parent Fife hold its place where early frosts are not feared, but the new breeds are invaluable in latitudes where a single early frost puts in jeopardy the labours of an entire year. We need not suppose that the process of adjustment to northern conditions has yet reached its limit.

The limits of this paper allow little more than mere mention of the profound effects on American wheat culture, of conditions of production, manufacture, and transportation. The vast interior plain of North America, ranging from warm to cold temperate as one passes from the lower Mississippi to the upper Mackenzie, has provided not only an unlimited expanse of soil, but offers a surface on which the modern machinery of production and transportation can operate. The plains of Russia and Argentina fall into natural comparison, but here the inventive genius and enterprise of the North American step in and give present supremacy, and, so far as we can see, this advantage will project itself over many years of the future.

We may indeed consider transportation as important as production, for otherwise wheat has little value to grower or consumer. Genesee wheat was little more than the bread of a few pioneers before the digging of the Erie canal. To send a barrel of flour from western New York to Philadelphia cost $1.25.‡ Grain and flour in general could not bear the cost of transportation for more than 150 miles. In 1825, 50 cents per bushel was considered a large price on the Ohio river, and indeed, after a haul of several days to the river, the farmer commonly got 25 to 30 cents, and that in trade.§ In that year wheat brought 25 cents in Illinois, 80 cents in Petersburg, Virginia, and flour $6 per barrel in Charleston, South Carolina. Similar differences prevailed in France, for in 1847 the average difference of the price per hectolitre in different parts of that country was 26 francs. Since 1870, the

* 'Preston and Other Early-ripening Wheats.' C. E. Saunders, Cerealist. Bull. of Central Experimental Farm, March, 1908.

† Two hundred new varieties are said to be now in the process of testing at the Canadian experiment stations.

‡ McMaster, 'History of the United States,' vol. 3, p. 463.

§ F. J. Turner in 'American Nation,' vol. 14, pp. 105–106.

difference has averaged 3.55 francs.* Similarly, prices have become equalised among nations as well as sections, and there is now a world market for wheat, which, according to the experts in economics, cannot be widely or for long disturbed by speculation. The world's crop is becoming available for the world's hunger, and in this transformation the trans-Atlantic highway and the American railway and waterway have borne the largest part. The same author says, "In respect to no other one article has change in the conditions of production and distribution been productive of such momentous consequences as in the case of wheat."

It was the building of railroads and the development of lake navigation that enabled the states of the old North-West to replace the Atlantic states as the grain centre, and which in turn gave the new North-West its present supremacy. And now history repeats itself in the Canadian North-West, in the multiplication of trunk lines and spurs, in the extension of through lines of transportation from Europe to the St. Lawrence, from the St. Lawrence to the Pacific, and from Vancouver and Prince Rupert to the Orient. The grain elevator also has extended its useful sway from Buffalo, Chicago, Minneapolis, and Duluth, to Winnipeg, Prince Albert, and Edmonton. The development of Pacific steamship lines, the opening of the Mississippi, a canal from Lake Huron to tide-water, and the possible utilization of the Hudson bay route, are all further steps in making North America the central bread-grower of the world.

The future of the United States in the universal wheat market is of peculiar interest both to her own citizens and to those of Canada. This depends on two factors: possible production and the possible population. As to both of these factors and the resulting future in export trade, opinions differ greatly. So acute an observer of our affairs as M. Leroy Beaulieu,† referring to the fact that for some years increase in wheat exports has not been more rapid than growth of population, believes this will continue to hold true. He grants that export wheat is likely to remain at its present high level for some time to come, but little increase is probable, the predominance of agricultural exports will pass, and manufactured products will take their place.

Mr. James J. Hill is yet more emphatic,‡ holding that "We are approaching the point where our wheat product will be needed for our own uses, and we shall cease to be an exporter of grain. There is still some room in Canada, but it will soon be filled." That there is some inconsistency in Mr. Hill's utterance appears in the view expressed in the preceding paragraph of his address, that only one-half of our farm areas is improved, that this half might be made, by ordinary care and intelligence, to double its production.

Similar views are set forth by Mr. J. C. Williams,§ who, referring to a falling off in production and the increase of home use, thinks it "quite possible" that the United States will become a permanent importer of wheat under normal conditions. To these opinions may be added that of Dondlinger:‖ "With the increase of population and local consumption, the internal and export movement of wheat will greatly decrease, and American wheat will be a factor of declining importance in the international grain trade." By American, this author no doubt means the product of the United States. He holds that diversification and rise of land values will decrease wheat acreage in the west, though this loss may be in a measure offset by the adoption of new areas in east and south.

In addition to these recent views, it is not out of place to observe that other

* 'Rand's Economic History since 1763,' p. 315.

† 'The United States in the Twentieth Century.'

‡ Conference of Governors, 1908, *Proceedings*, p. 72.

§ *Science*, N.S., vol. 21 (1905), p. 458. ‖ 'Book of Wheat,' p. 305.

and earlier prophecies now read curiously in the light of history. Edgar * quotes the conviction of John H. Klippart, writing in Ohio in 1859, that the limits of the wheat area in the United States had been reached, and that, without increase of yield, the surplus would "by the next census be measured by the algebraic quantity of minus." So late as 1884 a high foreign authority expressed the opinion that the wheat trade in America had reached its limit, because of the exhaustion of the soil and the prohibitive cost of freight from remote districts. These forecasts may well have less real basis than those of recent years, but they at least hint at the pitfalls of prophecy, and admonish us that human wisdom rarely covers all the unknown factors of a hard problem.

It will be prudent, therefore, to discuss the first of the two great factors in a wholly general manner. Can the United States largely increase its crop of wheat? Another wheat expert, Mr. E. C. Parker, writing in the *Century Magazine* in September, 1908, less than one year ago, thinks the home demand will soon stop exporting in any quantity. At the same time, he exhibits a strong array of means for strengthening the industry, and considers it "hard to imagine a wheat famine in the immediate future." Indeed, to fear for the wheat-supply of many generations to come is pessimistic. According to Mr. Parker, we shall have bread enough, but not to spare.

Some means of increasing the product have been considered. It may be admitted that increase by irrigation for export uses is more than doubtful, but it may also be claimed that watered lands will largely care for the bread of the increasing Cordilleran population. If agricultural exploration has given us a crop of 50 million bushels of durum wheats, the extent of available semi-arid lands suggests the probability of a large increase on demand. The production of early wheats will increase the Canadian crop more than that of its neighbour, but may aid in naturalizing the grain at higher altitudes in the West. There is an unknown amount of land east of the Mississippi to be rendered fit for cereals by drainage, for, as compared with Europe, we of North America know nothing about utilizing waste lands.

It is wise, therefore, to accept the dictum of a recent writer,† that "the future growth of cereal production will depend more upon improved methods of agriculture than upon the addition of new lands." Any one with confidence in the new American agriculture must, it seems to the writer, have large faith here. A table of comparative yields per acre is not a pleasant sight to a citizen of the United States. The record of a few leading countries is appended. It gives the average 1899 to 1904.

United Kingdom	32·4
Germany	28·1
France	20·8
Hungary	17·6
United States	13·7
European Russia	9·7

The yield for Canada in 1904 was 16·8 bushels. In 1908 Canada's yield of spring wheat (the bulk of her crop) was 16·03 bushels, and of winter wheat 24·40 bushels. It should be added that in the United States the yield for 1904 was 14·5 bushels. For 1908 the yield was slightly under 14 bushels. Reasonable confidence in the soil and future tillage south of the 49th parallel offers hope of large increase in the coming generation. Sixty years ago France was producing

* 'The Story of a Grain of Wheat,' p. 87.

† E. L. Bogart, 'Economic History of the United States,' p. 295.

less than 15 bushels per acre. A duty on imports practically prohibitive has forced the adoption of thorough tillage, and made it necessary for the French farmer to fertilize and use every other expedient for winning the largest result from his small fields. It may be said that labour conditions are very different, but the fact remains that these anciently tilled fields have been made to grow a vastly larger crop than they raised seventy-five years ago. It is significant that the farms of the United States average 150 acres, while the French farms average 20 acres. Leroy-Beaulieu refers to our small outlay for labour as evidence that we have little intensive cultivation. The writer of this paper has elsewhere shown * that east of the arid region we had, at the last census, but one agricultural worker for each 91·4 acres. Such facts are eloquent of our future possibilities, not only in wheat but in every product of the soil. What is true of the United States is more true of Canada with its ample soils and sparse population.

A South Carolina writer † asserts that tillage has, in some cases, made an increase per acre of more than eight bushels. Prof. Harry Snyder of the University of Minnesota asserts that the "yield per acre of wheat in the United States is much less than the soils are capable of producing." ‡

Mr. W. C. Ford, referring to the increased yields of France,§ utters a general principle which should be the inspiration of every North American farmer and the basis of reasonable optimism for every loyal citizen of the New World, "To this march of scientific agriculture there is no end." California is said to have used six times as much artificial fertilizer in 1900 as in 1890, and one of the latest bulletins of the Minnesota Agricultural Experiment Station, of date June, 1908, deals with the rotation of crops. Fertilizers even in the Red river valley are said to have increased the yield in some cases from fifteen to twenty-six bushels. Minnesota is not an old state, but is taking up the problems of the present and the future, and is quoted here, not as an exception, but as a sample of general practice throughout the United States.

The other great factor in the wheat problem is the increase of population. Space forbids more than a word. The writer has given his views on this somewhat difficult subject in another place.‖ In his belief, the ordinary prophecies of increase in the coming generation are exaggerations. Mr. James J. Hill, for example, thinks we shall have 200 million people in the United States by 1950. Let the reader observe the following rates of increase:—

Decade before	1880	...	...	30·2	per cent.	increase
„	„ 1800	...	...	25·5	„	„
„	„ 1900	...	...	20·7	„	„

Here is a drop of nearly 5 per cent. in each decade. The population of 1899 (census of 1900) was 76,085,794. The population for the Thirteenth Census, now about to be taken, may be estimated at 88 millions. This gives an increase of 15·6 per cent. in the last decade, and maintains the descending rate of previous periods. If we allow a drop of only 1 per cent. for coming decades, there would be in 1949, the year of the Seventeenth Census, a population in round numbers of 144 millions. This is a sufficient comment on the prevailing extravagances in estimating our future numbers in the United States. It is, perhaps, more possible that 1950 will not see a population of more than 130 millions. But let us grant

* "Distribution of Population in the United States," *Geogr. Journ.*, October, 1908, p. 383.

† *S.C. Bull.*, vol. 56, p. 12. ‡ Art. "Wheat," *Encyc. Americana.*

§ *Pop. Sci. Monthly*, vol. 53 (1908), p. 8.

‖ *Ibid.*, September, 1909, "Capacity of the United States for Population."

150 millions in no very distant future. At six bushels per capita, 900 million would be needed at home. More than 700 million bushels have already been raised in one year. An increase of four bushels per acre on present wheat lands would about fill the gap. An increase of 10 to 12 million acres under good tillage would still provide for the present scale of export. It is safe to expect that this cereal, as an essential food, will press for its place, and all reclamation and adaptation of lands now idle, to other crops, will tend to release land for wheat.

Regarding it as fairly probable that the United States will not materially increase its exports of wheat, the Canadian product assumes new interest, not only for the farmer and economist of the Dominion, but for every student of the subject. It would be needless, and indeed presuming, to bring to this place from across the border detailed statements as to the history, or confident predictions as to the future, of Canadian wheat.

In comparison with some of its competitors, Canada is old in the industry, having raised over 20 million bushels in 1827, while Argentina began to raise wheat in 1882. Recent developments in the North-West belong to the experience of many who are still foremost in the field. Fort Garry has been Winnipeg but for a single generation, and the Canadian-Pacific railway entered the city so late as 1881. It has already been observed that the Canadian yield is high, owing to the native fertility of its prairies, and the greatest crop ever raised from unfertilized land is credited to Western Canada in 1901, when 63,425,000 bushels were raised on something more than 2,500,000 acres, an average yield of more than twenty-five bushels.

The following tables show the progress of wheat in Manitoba, Saskatchewan, and Alberta from 1900 to 1908. The figures are kindly furnished the writer by Mr. A. Blue, chief officer, Census and Statistics Office.* The product for 1908 is taken from the *Census and Statistics Monthly*, Ottawa, December, 1908.

Manitoba.

	Bushels.		Bushels.
1900	18,852,929	1905	47,626,586
1901	50,502,035	1906	54,472,198
1902	53,077,267	1907	39,688,266
1903	40,116,878	1908	50,269,000
1904	39,162,458		

Saskatchewan.

1900	4,306,091	1905	31,799,198
1901	11,956,069	1906	50,182,359
1902	13,110,330	1907	27,691,601
1903	15,121,015	1908	34,742,000
1904	15,944,730		

Alberta.

1900	797,839	1905	3,035,843
1901	857,714	1906	5,932,267
1902	850,122	1907	4,194,435
1903	1,200,598	1908	6,842,000
1904	938,200		

The exports of Canadian wheat ranged from 16 and 9 millions respectively in the years 1900 and 1901, to a maximum of 43,654,668 bushels in 1908. The Ontario crop is usually over 20 million bushels, but it is from the north-western

* Letters of March 19 and 24, 1909.

provinces that future growth is chiefly expected. Dr. William Saunders * states that during 1908 experiments have been carried on in the Peace river district, at Fort Vermilion, 350 miles north of Edmonton, where the crop amounted to 35,000 bushels. He adds the important statement that "there seem to be no climatic differences there which are more difficult to overcome, than in the immediate vicinity of Edmonton."

If there be prophecy as to Canada's future product, her own experts must play the part of seer. We have not seen that Dr. Saunders retracts or in any way modifies his "reasonable prophecy" of 1904—that wheat, grown on one-fourth of the land suited to it in the Canadian North-West, with the yield of Manitoba for the previous decade, would bring a crop of more than 800 million bushels, which, as he shows, would feed 30,000,000 of people in Canada and three times supply the import need of Great Britain. If there be such a surplus of good soil as three-fourths, this would leave ample room for diversified crops, and for such rotations and fallowing as might be needful in future years to meet the declining production of the prairie soils.

Sir William Crookes, in 1898, allowed from credible estimates six million acres of wheat land for Canada in the following twelve years. The acreage of 1908, after ten years, but slightly exceeded his figure. His fears, however, as to inadequate population to work the wheat lands are not likely to be realized. When he read his address at Bristol he could not have foreseen that spectacular migration across the border from the south, which now plays so large a *rôle* in the North-West. In the year 1898 this immigration brought 9119 settlers into Canada. In the fiscal year of 1908–1909 the number had risen to 59,832, and had become a theme of interest to both countries. Sixty thousand settlers, mainly going to wheat farms and bringing in capital and experience, means immediate and large expansion of Canadian wheat, and an annual product per capita far exceeding anything that any wheat-raising country has known.

The population of Canada has always increased slowly, beginning with 240,000 in 1801 and rising in 1901 to 5,371,315. But it is precisely in the wheat provinces that recent percentages of increase have been enormous, so that Canada promises to give itself to a great agricultural specialty, and remotely, if ever, will come the time when her population will press hard upon her productive capacity. Unlike the United States, she must confine herself to products of temperate climates, and her greatest reliance for exchange must, it would seem, be breadstuffs. Immigration into Canada since 1901 has brought more than one million people, and if the population in 1908 were seven millions there was a per capita production of wheat of 16 bushels. This ratio will, no doubt, be much higher in the near future.

It is easy to refute prophecies which the event has already nullified, but it is, nevertheless, sometimes useful to recall them. In his famous address of 1898 Sir William Crookes concedes his statements to be alarming, but asserts they are based on stubborn facts, and that "England and all civilized nations are in deadly peril of not having enough to eat . . .; as mouths multiply food resources dwindle . . .; our wheat-producing soil is totally unequal to the strain put upon it." Great Britain then needed 240,000,000 bushels of wheat, of which she raised one-fourth and imported the rest. Sir William regards as a burning question what to do to avert starvation if crops should fail or nations combine in hostility, especially in view of the world's increase of bread-eaters. The wheat-growing area was strictly limited; there was no land left in the United States without cutting into maize, hay, and other crops, and the export of 145,000,000 bushels would soon be required

* Letter to the writer of date March 15, 1909.

at home. In the world's crop for 1897–1898 he gives the United States 510,000,000 bushels. As it turned out, there were in the process of harvest, when Sir William was reading, 675,000,000. The average crop for eleven years, 1898–1908, has been 643,668,762 bushels, giving an average increase beyond his figure of 133,668,000 bushels, almost enough to cover the export amount then stated. The world's crop for 1897–1898 was said to be 1,921,000,000 bushels, leaving a deficit, but for supplies carried over, of 400,000,000. He thought the wheat lands of all nations, brought to their utmost capacity, might raise the total to 3,340,000,000, or within 17,000,000 bushels of what the eaters of wheat bread would require in 1931. We now know that the world's crop eight years later, or in 1906, was 3,423,134,000 bushels, and the limit is nowhere in sight, and cannot be conjectured within a billion bushels by the keenest student of the wheat problem. Sir William felt that performance had lagged behind promise in Canada, and he observed the modest export of less than 9,000,000 bushels, which has now been raised nearly fivefold.

It is hazardous to set limits to wheat in view of possible unknown factors of production, and discussions have not taken sufficient account of the limitation of population which exhibits itself among the nations of higher standards, which are precisely the bread-eating peoples. Without regard to wheat this limitation would be operative, but any pressure on the wheat-supply would foreshadow itself before the pinch came, and would tend still further to restrictions of population. We may therefore comfortably come back to an earlier conclusion of an American economist,* "In short, it would seem as if the world in general, for the first time in its history, has now good and sufficient reasons for feeling free from all apprehension of a scarcity or dearness of bread."

Looking, in conclusion, at the world field, the only great importing countries are in Western Europe, or more truly North-Western Europe. An increased demand in that region should readily be met by development in Canada, Russia, Argentina, Egypt, India, South Africa, and Australia. We may thus even leave out the United States, and we might omit India, should ampler distribution of her wheat at home be made to avert her too frequent periods of famine. Of the greater producers, Argentina is far from her market, is undeveloped and in some degree uncertain. Russia is backward, and will not for more than a generation bring her vast resources to full effect in the world's market. It is North America which has the land, the progressive appliances, the skilled energy of production, and the facilities of transportation to supply the bread market of coming decades. No citizen of the great Republic need harbour a jealous thought if in that market the major place should come to his northern neighbour.

FLOODS IN THE GREAT INTERIOR VALLEY OF NORTH AMERICA.†

By LUELLA AGNES OWEN.

THE conditions producing these floods, the diversified character of their consequences, and the possibility of advantageous future control of the devastating surplus, are questions of vital interest to the American nation, on account of their ever-increasing importance to a group of the most richly productive states and to the traffic of the entire country.

* Mr. D. A. Wells in 'Recent Economic Changes,' p. 177 (1889).

† Read at Section E, British Association, Winnipeg, August, 1909.

Although the obvious causes are excessive local rainfall with run-off from the melting of heavy snows in the mountains, it is possible that both may occur without serious results if weather conditions shall favour an early and slow-melting season, beginning with open rivers to carry out the flow; and if the excess of rainfall shall either follow a season of comparative drought in the valley or fall so gently that nearly all sinks into the natural storage reservoirs of the subsoil. The violent downpour, on the contrary, is mainly lost in run-off which goes to swell the flood conditions, carrying with it in solution a considerable quantity of surface soil usually designated "wash." This ancient process of denudation has recently become the subject of vigorous protest as "the incalculable, irreparable loss of fertile soil from our mountains, grazing lands, and fields," the loss for the whole country being estimated approximately at one billion tons per annum. Extensive forest planting is urged as the method of reducing this loss to less distressing figures; but all cultivated lands must still remain subject to the levy of Nature's tax, and mountain peaks also must continue to be denuded of the products of their slow disintegration to contribute fresh elements to exhausted soils.

Interest in the great floods increases with study of their various developments under the influence of local conditions, the present year affording opportunities especially favourable to purposes of such investigation. Exceptionally heavy snowfall in the Rocky mountains gave an early forecast of the volume of run-off to be anticipated after thawing should commence, which might have been as early as March or April, but the severe winter dragged its length over all the spring months, and heavy snowfall continued into June, when the "June rise" might reasonably have been expected in the lower valley. This rise, however, was delayed beyond every precedent, and recorded its highest mark at St. Joseph on July 9, at Kansas City on the 13th, and at St. Louis on the 16th, making it the latest of all floods of record in sixty-five years with the single exception of that of September, 1905, due wholly to local rains. Great as was the volume of run-off forced rapidly down into the valley by the sudden warmth of midsummer eating into vast snowfields, it might possibly have passed through the channel of the Missouri and reached the Gulf with very little overflow if it had not been met everywhere below the Dakotas by streams at high flood from excessive local rainfall repeated at frequent intervals. Any fairly intelligent farmer or other weather-observing resident has sufficient knowledge of valley meteorology to forecast such rains to meet the high stage of mountain overflow, even though innocent as their flocks and herds of thoughts pertaining to cause and effect of air currents.

During the early stages of high water the contributions from swollen local streams greatly increase the volume and add violent speed to the already swift current of the Missouri and lower Mississippi rivers. After the higher stages are reached, these strong and swift currents act as effective dams thrown across the outlets of smaller streams, and, by checking their discharge, force a deluge of backwater over the valley of each. This peculiarity was a predominating feature of the high water in Missouri, Iowa, and Kansas in the present year, as shown by the Hannibal and St. Joseph railroad being wholly impassable for several days for the first time in its just completed fifty years of service, and by the serious overflow over the full length of Des Moines river. The conditions have been so many times repeated at Topeka and other points in Kansas by the closing of the Kaw at Kansas City that the familiar picture requires neither description nor comment.

Since local circumstances so largely affect the volume carried by the main stream and are known to vary with different seasons, it becomes evident why the

geographical point of greatest flood importance is also variable. Thus the highest stage ever reached at St. Louis by any flood of history or tradition was that always known as "the Great Flood of '44"; at Kansas City the flood of 1903 reached a stage 1 foot higher than the record of 1844, while the highest at St. Joseph, Omaha, Sioux City, and Yankton was in 1881. These three are the most notable of fourteen great floods that have made records in the valley within the past sixty-five years, the record of each being in some particular peculiar to itself. In the memorable year of 1903 an exceedingly high stage of water was general throughout the entire valley between the mountain ranges of the east and west, and resulted in the first public approval of the proposed system of vast storage reservoirs on headwaters for the supposed future control of such devastating surplus. Few of the river cities of the interior are situated like St. Joseph on the bank of a turbulent river, and yet at a safe elevation above the flood-plain, so the losses of that year were widespread and financially enormous, being estimated for the vicinity of St. Louis alone at more than the price paid to France for the territory of Louisiana. An involuntary sojourn in Kansas City during the appalling period of the cresting of this flood and the beginnings of its subsidence, afforded a most valuable opportunity for observations. On May 30 the waters spread over the southern entrance to the city and closed the last approach, shutting off all communication with the outer world even by wire or boat—landing-places being lost beneath the waves of a rushing torrent carrying a burden of promiscuous wreckage, including trees and houses. The valley was filled from bluff to bluff with the turbulent, muddy waters which on June 2 completely submerged the entrances to the main waiting-room of the Union station, only the transom-glass remaining visible. This high stage continued stationary for two days, and then began to very slowly subside, proving the existence of a drainage basin with its only outlet towards the east. Further observations revealed that within a distance of 60 miles the surrounding watershed attains altitudes of 1000 to 1100 feet above sea-level, forming a barrier capable of having retained glacial floods of sufficient depth to have deposited the loess bluffs with more than their present height. Prof. Geo. Frederick Wright, a few weeks later, traced this barrier across the state, and found proof of its importance in relation to aqueous deposition of loess in the presence of northern boulders on the summit of the bluff near Tuscumbia, a point previously supposed to have been well beyond the drift limit.

The flood of 1881 was peculiar in that it occurred in March and the first half of April. Unprecedented early melting in the mountains sent out summer torrents before the upper Missouri was clear of its winter ice, which caused the formation of a vast ice-jam near Yankton. This threw a great body of water over the surrounding country, where it accumulated to such depth that a river steamboat was carried more than 6 miles inland by the current and left to its fate. When the jam finally yielded to explosives, the water rushed down the Missouri in a flood whose front presented the peculiar appearance of a series of perpendicular walls from 2 to 4 feet in height. Augmented in its course by the inevitable rains, it spread from bluff to bluff throughout the entire length of the valley.

The flood of 1908 was due to excess of rain at the time of the "June rise," but its unusual phase was copious rains in even the arid portions of Montana and Wyoming, whose flooded streams swept over valleys usually exempt.

The great flood of 1844, on the contrary, affected no portion of the upper river. An old account states that, as usual, it was caused by heavy rainfall with the June rise. "The downpour had been excessive for weeks, and about the middle of June all the lowlands along the river, from the mouth of the Kaw to the Gulf of Mexico, were submerged, the waters extending over the entire valley between bluffs across

the state of Missouri, and of such depth that steamboats disregarded the channel to make short cuts across fields. A marked peculiarity was the fact that the flood was confined entirely to the lower river. It did not extend above Kansas City, and the river above that point during the entire season was unusually low."

The flood of September, 1905, was exceptionally notable for two reasons. It was due entirely to rainfall; and occurred at a season which is generally the dryest portion of the year, and the outflow from the mountains is also at its lowest stage.

The consequences of these high waters are necessarily varied in character, but are by no means essentially destructive, since Nature's law of compensation has never been repealed, the losses of one section becoming accessions to another. In present geographical development the results of geological progress are written. Study of this historical record revealed the origin of the great valley to have been in the upheaval of two mountain ranges, whose drainage gathered in lines of depression in order to gain the level of a receding ocean; and through all the changes of successive periods, including glacial and inter-glacial epochs, solid matter varying in quantities as well as in chemical richness was carried in suspension by strong currents to add depth to the valley and extend it for hundreds of miles southward by forcing back the sea to the present limit of the Gulf of Mexico. But man, having taken possession of the unfinished country for the richness of its products, protests against the continuance of the vast scheme of removal and rebuilding as entailing loss of his possessions in one region to overwhelm and destroy his unguarded works in another.

Since it is known that floods are not of annual occurrence, that they are confined almost exclusively to the lower and middle portions of the valley, and their chief cause is excess of local rainfall, it can be readily observed that storage reservoirs on the headwaters of the Missouri could by no possibility affect any perceptible degree of relief. Some apprehension might, however, be justly entertained that in diverting the headwaters from the main stream its already well-populated valley would be wholly deprived of the present pure and wholesome supply of mountain water, of many miles of commercially navigable stream, and the purifying element of a magnificent drainage system. Means of safe-guarding against flood disasters would, therefore, appear to offer more reliable promise of effectiveness if closer connection should be established between the principal cause of trouble and the location of projects designed for actual and ready relief. When such measures shall be adopted they will doubtless include a substantial levee wherever experience has shown its necessity to be imperative, and a system of emergency canals. If the latter should be so constructed as to be serviceable as public highways at all times when not temporarily closed for emergency service, they would meet with general favour rather than the opposition of property-owners relinquishing rights.

THE VOLCANIC ERUPTION IN TENERIFFE.

After a period of quiescence lasting for a hundred and eleven years, the volcano of the Peak of Teneriffe has again burst into activity, and considerable streams of lava have flowed down its north-western quadrant, threatening the safety of some of the little villages which are planted on its slopes. Another has been added to the list of important eruptions of the twentieth century, a list which already includes the West Indian eruptions of 1902–1904, the great outbreak of Vesuvius in 1906, the important eruptions of Savaii in Samoa during the last two years, and the minor eruption of Etna in 1908.

The whole of the Canary islands, with Madeira and the Azores, consist of recent and Tertiary volcanic rocks, and the Peak of Teneriffe, which rises to a height of 12,192 feet, is one of the greatest volcanoes of the world. The Peak is a steep-sided cone which stands within a great circular crater or "caldera"; the floor of this, known as the "Cañadas," has an elevation of 7000 to 7500 feet, and is covered with pumice and volcanic sand. This caldera is the remains of the first period of activity, and bears somewhat the same relation to the Peak as Somma and the Atrio have to Vesuvius. Pumice and black rugged flows of obsidian cover the sides of the Peak, and many parasitic craters of all sizes stud its surface. On the west of the main summit, a large crater, known as the Chahorra (10,500 feet), is a conspicuous feature; it is separated from the Peak itself by a saddle-shaped depression occupied by very rugged flows of obsidian. At the top of the Peak there is a small crater, but for centuries this has been in a state of repose, or, more correctly, in a solfataric condition, and the rocks around it are soft, earthy, and impregnated with sulphur. From Chahorra, on the other hand, great lavas were emitted in 1798, and this seems to be the active centre which has superseded the summit crater. The lava of that eruption broke out along an east-and-west line of fissure situated near the base of this cone, and on the fissure several parasitic cones were formed. After overflowing the level surface of the Cañadas below, it spread out in the direction of Guia, a hamlet to the west of the Peak, but was hemmed in by the cliffs which face the Cañadas on that side, and came to rest before much damage was done.

Nearly a century earlier (in 1706), a great lava-flow destroyed Garachico, which stands on the coast about 7 miles north-west of Chahorra. This lava is still in a remarkably fresh condition. It arose probably from fissures and small cones in the north-west corner of the old Caldera, and found an easy outlet down the valley which breaches the old cone on that side, and leads down to Garachico. The only other eruption which has taken place since the occupation of the islands by the Spanish was in 1704, when a crater was formed on the south-east side of the volcano, near Guimar, and emitted a large stream of lava which threatened that town. It destroyed the church, but stopped before reaching the other houses, and the volcanic activity lasted for a year.

In Teneriffe small earthquake shocks generally precede the eruptions, but these have never proved of great intensity. Apprehension, however, had been awakened among the inhabitants for some months past owing to their unusual frequency, and it is said that on some days the earth-tremors had been continuous for hours. They were felt most about Icod, on the north side of the island, but attracted attention also in Orotava. On Thursday, November 18, in the afternoon, detonations were heard by the residents in Orotava, like the discharge of heavy cannon at intervals of a minute or less. Shortly afterwards word was received that an eruption had taken place near Garachico, and over the intervening hills smoke could be seen ascending in the air. The noises continued all night, and when darkness fell the glow of the red-hot lava was visibly reflected from the clouds. Many of the inhabitants hastened to leave the villages on the north side of the mountain and take refuge in Orotava.

Next day it became clear that the eruption was really in the vicinity of Santiago, which stands 6 miles west-north-west of the peak. A stream of lava about half a mile wide and 8 feet deep was slowly travelling down the valley towards the village. Thereafter reports arrived that another lava-flow was proceeding in a northerly direction towards El Tanque, which lies about 2 miles from Garachico. The rate of advance is variably stated, but it must have depended largely on the slope and configuration of the ground. Some of the telegrams

published in the newspapers give the length of the lava-stream as 3¾ miles, and say that it advanced half a mile in twenty-four hours. The fact that it was near Santiago on the 19th shows that it must have flowed rapidly at first, but its progress was arrested or greatly reduced in two or three days, as it is certain that Santiago has not been invaded, and the stream descending towards El Tanque has also come to rest.

The latest reports state that the eruption took place on level ground to the south-east of Mount Bilma, and not far from Chahorra. The craters are situated on a fissure which runs west 15° N. at an elevation of 1525 metres. While the fissure at present active is probably not the same as that from which the lava of 1798 proceeded, it is sufficiently close to it to confirm the opinion expressed by Leopold von Buch in 1829, that this is the principal orifice of the Peak under present conditions. Many parties have visited the scene of the eruption from Orotava and other places, and have found it easy to get within 400 yards of the craters. The wind during the early part of the outburst was persistently from the south, and a cone of ashes, stated to be 400 to 500 feet high, has been built up on the north side of the orifice. Clouds of steam and showers of stones were being projected at intervals from the central crater and from two apertures on the sides of the cone, but the flow of lava seems to have lasted for only a few days, and had nearly ceased on November 26. The distance from Santiago is 3 or 4 miles.

While it is too early to conclude that the eruptions are at an end, there are certain inferences from the facts of which we are in possession that may be safely drawn. As on two previous occasions (1706 and 1798), the north-west quadrant of the volcano has been the seat of activity. Near the base of Chahorra, or to the north-west of it, a fissure has opened and a large amount of lava has been emitted, which has taken its natural course down the valleys towards the sea. The great ring-shaped crater-wall which girdles the base of the Peak is a sufficient protection to the other parts of the island. Probably the lava will continue to creep forward slowly for some time, but the district is not thickly inhabited, and there has been no loss of life. It is interesting to note that the history of the Peak indicates that eruptions tend to recur at intervals of about a century.

JOHN S. FLETT.

CENTRAL ASIAN ARCHÆOLOGY.*

THESE two quarto volumes present us with records of considerable value, dealing with the archæological, zoological, and anthropological aspects of a site at Anau, near Ashkabad, in Turkestan. Russian work in this region has been concerned mainly with geology, and even so is inaccessible to the average Englishman; so that we have here a revelation of prehistoric culture which fills up one of the great gaps in our knowledge of the Orient. The editor is to be complimented on his presentation of the results, which are fully detailed, excellently illustrated, and altogether adequate.

Those who perused the record of the preliminary expedition of 1903 will remember that it was a reconnaissance. Prof. W. Davis, of Harvard, and Mr. Ellsworth Huntington made a rapid survey of the Western Tian Shan mountains, in order to get "a broad view of the region and its development," while Prof.

* Explorations in Turkestan. Expedition of 1904. Prehistoric Civilizations of Anau. Origin, Growth, and Influence of Environment. Edited by R. Pumpelly. 2 vols. Carnegie Institute of Washington. Publication No. 73. 1908. 10$.

Pumpelly and his son examined the region from Sir-darya to the Pamirs, mainly for the choice of a suitable site for excavation.

The various members of the expedition "established independently positive proof of at least three distinct glacial and interglacial epochs of the Glacial period, and obtained abundant evidence of the deep-reaching reaction of these upon the topography of the mountains and plain." The relation of these epochs to the glaciation of Europe, particularly of Russia, was brought out. Prof. Pumpelly further tells us emphatically that Richthofen's theory of the wind-borne origin of loess was duly confirmed, and adds that it is the direct product of deflation and disintegration, and arises from alluviation or dry deltas and dry flood plains.

In the report before us, Mr. R. W. Pumpelly determines the changes and history of geological movement from the Pliocene period, the weathering, glaciation, and alluviation of the mountains, deserts, and oases, and presents a study of deltas and oases in connection with their occupation by man. But the interest of these two volumes centres in the archæological work, the excavation of a site chosen in 1903 at Anau, about a quarter of a mile from the Trans-Caspian railway and a few miles beyond Ashkabad.

Prof. Pumpelly deserves congratulation for his great pluck in undertaking, as he tells us, on the verge of threescore years and ten, such an arduous expedition. As far back as 1863, when travelling in China and Mongolia, he had become interested in the phenomenon of the progressive desiccation of the Trans-Caspian region. It was not, however, until forty years later that the opportunity of testing his surmises presented itself, in the form of a grant from the Carnegie Institute. The object of the expedition cannot be better put than in his own words :—

"It had long seemed to me that a study of Central Asian archæology would probably yield important evidence in the genealogy of the great civilizations, and of several at least of the dominant races; and that a parallel study of the traces of physical changes during Quaternary time might show some coincidence between the phases of social evolution and the changes in environment; further, that it might be possible to correlate the physical and human records, and thus furnish a contribution to the time-scale of racial geology."

Everybody will sympathize with this aim. We are sadly lacking in trustworthy chronology earlier than 3000 or 4000 B.C., and what palæontologist, prehistoric archæologist, or anthropologist has not longed to be able to date, with a fair approximation to the truth, the great landmark of the bridging of the prehistoric European-Asiatic "Mediterranean," and the free ebb and flow of animal migration between Asia and Europe?

Before the end of the 1903 expedition, Prof. Pumpelly realized that the problem was not merely geological, but archæological, and fortunately obtained the aid of the experienced archæologist, Dr. Hubert Schmidt, of Berlin. The site chosen consisted of two mounds, 40 and 50 feet high, and the city settlement of Anau. The northern kurgan had already been trenched twenty years before by General Komorof, and pottery lay on the surface and in the different settlement strata of the trench. The mounds represent, not tombs, but the *débris* of adobe dwellings, etc., of successive settlements of peoples, and these extend to a depth below the level of the plain. As the north and south kurgans and the city mound represent a sequence, with some gaps between, we have a very long period of time, represented by the accumulation of *débris* and sand of at least 170 feet. The earliest inhabitants built dwellings of sun-dried bricks; used flint sickles, but no celts; cultivated wheat and barley; spun; painted their pottery with geometric designs; later possessed domesticated sheep; and towards the end of the First Culture (third millennium B.C., according to Dr. Schmidt) began to use copper implements. This

Anau civilization, beginning with the Neolithic, passed through a lengthy Copper Age, but never a Bronze, and by the Fourth Culture period, i.e. at the top of the second or south kurgan, appears the Iron Age.

Dr. Schmidt, in seeking external connections for the culture at Anau, says, "The pottery of Anau and its ornamentation show a non-European character." The design of erect-standing triangles, the foundation of the tent ornament, is in direct opposition to the ancient and long-persisting horizontal and vertical ornament of prehistoric Europe. He finds that while the general culture and the early appearance of painted pottery, giving way to an undecorated ware, agrees with that of the old Tell of Susa excavated by De Morgan, the decoration, motives, and styles are quite different. Two objects help to determine the age of the settlements: a three-sided steatite seal of Cretan form, and a copper sickle with bent tang of Ægean shape. These were found in the lower stratum (Third Culture) of the south kurgan, and were assigned by Dr. Schmidt to a period not later than the first half of the second millennium B.C.

Turning to Dr. Duerst's examination of the bones of sub-fossil and later animals, we have a careful and skilled investigation of the remains of horse, ox, sheep, dog, camel, etc. The contributions to our knowledge of the horse are especially valuable, and one of the species appears to approximate closely to Prjevalsky's horse. He claims to have found a domesticated breed of sheep in the First Culture stratum and the shepherd dog in the Second. It seems a daring thing, in our present state of ignorance, to form an absolute chronology on the base of the differentiation of animal forms and their migrations, as deduced from their appearance in different places, but Dr. Duerst, in agreement with Prof. Pumpelly, does not hesitate to tell us that the shepherd dog appeared at Anau *c.* 5850 B.C., and that the turbary sheep attained its full development 6250 B.C. He adds, "According to Prof. Pumpelly's stratigraphic chronology, which is without doubt the most exact chronological table that we possess, the 20 feet of culture stratum at the base of the north kurgan dates from the latter half of the ninth millennium (8250 B.C.).

Prof. Pumpelly, with youthful confidence, sums up his results as follows: "The evolution of civilization has been traced backward to a time when, before its datings in Babylon and Egypt, man at Anau already lived in cities, cultivated wheat and barley, began the domestication and breeding of the useful animals which are our inheritance, and possessed the fundamental industries and arts, including a certain amount of metallurgical knowledge."

Whence this difference between Prof. Pumpelly's date of the ninth and Dr. Schmidt's of the third millennium B.C. for the beginnings of the civilization at Anau? Prof. Pumpelly says that Dr. Schmidt did not include the zoological testimony of Dr. Duerst, the evidence from the "cyclic" changes, and the accumulation of *débris* on the site. Unfortunately, the cyclic changes recorded by the authors do not help us prior to the beginning of our era. The rates of accumulation of *débris* and sand are such an uncertain factor that no careful scientist would venture to erect a system of chronology upon them. Dr. Duerst appears to owe his dates in the main to Prof. Pumpelly. And the latter, when the expedition became a possibility, suddenly realized, as he admits with praiseworthy candour, that "he had done practically no reading in connection with the subject, and was ignorant of the amount of thought and effort, that during forty years had been devoted to Central Asia." And he allows us to see that he set out to find the "home of the Aryans" and the "cradle of the human race," unaware of the changes that had come over scientists' views in relation to these matters or of the battles that had raged around them. Readers will be disappointed in the failure to correlate physico-geographical changes with phases of social evolution antecedent to

our era. To attempt to establish in one season's work an absolute chronology for a newly discovered civilization when half a century's work in Egypt has still left us in considerable uncertainty as to dates prior to 1580 B.C. seems presumptuous, and the evidence presented tallies as well with the view that Babylonian and Egyptian beginnings antedated Anau as with the reverse.

Although this extravagant chronology vitiates many of the conclusions, it does not detract from the value of the mass of records of all kinds and their excellent presentation in these volumes. C. H. H.

DR. LONGSTAFF'S HIMALAYAN EXPEDITION, 1909.

HAVING at length had an opportunity of testing my instruments and compiling my results at the Survey Office at Dehra Dun, I hasten to send my first communication for the *Geographical Journal*.

One of the inducements which decided me to make for the Saltoro pass was the knowledge that the main axis of the Karakoram had never been crossed by any traveller between Younghusband's Muztagh pass and the Karakoram pass itself, a distance of 100 miles in a straight line, and 150 miles as measured along the accepted crest-line. Although the name Saltoro pass has been handed down to us by tradition, there is no record of any one, European or native, having crossed it, and its exact position was uncertain.

When Neve, Slingsby, and I crossed this pass (the Saltoro, 18,200 feet) on June 15 last, we saw before us a huge glacier bounded to the north and east by a lofty range of snow-clad peaks. At first sight we assumed that this glacier flowed northwards as shown on maps; but when, on the following day, we reached the main glacier and were able to examine it, we found that it was flowing to the south. In September, following the independent suggestions both of Colonel Burrard and Sir Francis Younghusband, and with the assistance of Captain D. G. Oliver, British joint commissioner for Ladak, I was able to make my way up the Siachen glacier (Saichar of maps) and establish its identity with the glacier we had visited and surveyed in June. But the Siachen glacier, instead of being some 20 miles in length as has always been supposed, turns out to be more than 44 miles long, and it pierces the range that has hitherto been regarded as the main Karakoram axis.

This discovery has shown that the Siachen is the longest glacier in the Himalayan system, and probably the largest outside the Alaskan and Polar regions, its only competitor being the Inylchek glacier of Merzbacher in the Tian Shan. When we remember that the Siachen glacier drains into the Nubra river, it becomes obvious that the basin of the Indus must extend much farther northwards than has been thought. In short, the Indus-Yarkand water-parting here follows a chain of mountains not shown on any maps, and lying some 20 miles north of the

high range upon which it has been hitherto located. It was extremely interesting to find that the actual facts accorded with the views expressed to me by Sir Francis Younghusband before we started on this journey.

To avoid any possible misunderstanding of my views, I must also add that I consider the description in the survey reports of the mapping of the Saltoro and Siachen regions, viz.: "Mr. Ryall made a rapid sketch of the country, but with sufficient precision to give a good general idea of its physical formation," to be a very modest statement of what was done in 1861 and 1862.

Perhaps our most interesting discovery has been the existence of a group of very lofty peaks, crowning this new chain of the Karakoram, and culminating (about long. 77°, lat. 35° 30′) in Teram Kangri, 27,610 feet in altitude. Thus if my measurements can be accepted, this new peak is only overtopped by Everest, K_2, Kinchinjunga, and Makalu. I feel very considerable hesitation in attaching such an immense height to a peak which has escaped the observation of the Survey of India; but this peak is not a satellite of K_2 or of Gusherbrum. It is the culminating point of a totally distinct *massif*, which so far has not been shown on any map. It should be remembered, also, that Colonel Burrard predicted of this region, that it was the most likely of all unexplored areas of High Asia to contain high undiscovered peaks. In any case, the fear lest I may subsequently be shown to be in error should not, I think, deter me from publishing the results of observations which have so far withstood a fairly severe examination by experienced judges.

If, in view of these new facts, we now reconsider our former ideas of the structure of the eastern Karakoram, we must place the main axis of elevation along a line drawn from K_2 to Teram Kangri, and on to the Karakoram pass. Whether the Karakoram is to be considered as consisting of two more or less parallel ranges, or whether it bifurcates, in the neighbourhood of K_2, we are as yet hardly in a position to state with certainty.

I cannot close this note without acknowledging my indebtedness for the assistance given me by Colonel Burrard, F.R.S., and the other officers of the Trigonometrical Survey, and by Dr. Gilbert Walker, F.R.S., and the Meteorological Department. But it must be distinctly understood that the Survey can accept no responsibility for any statements I have made in this communication. I have also to thank Colonel Longe, the Surveyor-General, for his offer of the services of a surveyor—an offer which I did not feel justified in accepting, as his whole time would have been wasted had we been unable to cross the Saltoro pass.

TOM G. LONGSTAFF.

REVIEWS.

ASIA.

'En Birmanie. Souvenirs de Chasse et de Voyage.' Par le Prince Grégoire Sturdza. (Paris: Plon. 1909. Pp. 236. *Map and Illustrations.*) An unpretending record of shooting experiences in Burma. The book is divided into two parts; the first consisting of extracts from the prince's diary, and the second of general remarks on the geography, the inhabitants, the products, fauna, and flora of the country. A variety of hints and information respecting clothing, equipment, and travelling necessaries are likely to prove useful to future sportsmen, as well as some notes on the habitats and peculiarities of the big game of the province. The illustrations are fairly good, the best being the likeness of the author and his *fidus Achates*, Captain Percy Smith, in whose company the sporting tour was undertaken.

'Les regions Moï du sud Indo-Chinois. Le plateau du Darlac.' Par H. Maitre. (Paris: Plon. 1909. Pp. 335. *Map and Portrait.*) M. Maitre's travels and reconnaissances in this part of Indo-China were carried out between September, 1905, and June, 1908, and the Darlac plateau, which formed the special scene of his researches, lies about halfway between the Mekong river and the east coast. As a monograph, dealing with a very imperfectly known region, this little work may claim to be fairly exhaustive, but there is not much therein to interest the general reader, for the Moï, a name applied by the Annamites to the Annam highlanders, are only semi-civilized and not distinguished for any special arts or manufactures beyond the rude appliances and weapons pertaining to a race who subsist mainly by hunting.

'The Adventures of John Smith in Malaya, 1600-1605.' By A. Hale. (Leyden: Brill. 1909. Pp. 335. 10*s.* 6*d.*) This purports to be a narrative adapted from original notes by a trader in the East, who ended his days in Patani as the adopted son of the queen of that place. But as we are told at the outset that John Smith is not the signature on the letters and other documents, we are left to conjecture as to the actual origin and value of the story, which, however, affords no little entertainment.

'Ancient Tales and Folklore of Japan.' By R. Gordon Smith. (London: Black. 1908. Pp. xv., 361. *Illustrations.* 20*s.*) As the far Eastern empire is rapidly modernizing, it is well that such collections as this should be preserved, and this volume preserves one in attractive form. The illustrations are exceedingly clever.

AFRICA.

The South Central Sahara.

'Missions au Sahara.' Par MM. E.-F. Gautier et R. Chudeau. Tome ii. 'Sahara Soudanais.' Par R. Chudeau. Paris: Librairie Armand Colin. 1909. 83 *maps and text-figures*, 72 *plates.* 15 *fr.*

'Sahara Algérien,' the companion volume to M. Chudeau's work, was reviewed in the *Journal* for October, 1909, and some indication then given of the extremely valuable results obtained by the author of this volume and his colleague, M. Gautier. These are not books of travel. M. Chudeau, like M. Gautier, omits entirely any account of his wanderings, preferring rather to set forth systematically the results of his investigations. The part of the Sahara with which he is in the main concerned extends from the Ahaggar massif south to the Niger, east to Tibesti, and west to Mauratania. This includes not only the central regions where the Tuareg roam, but, along the Sudan frontier, that

> "Strip with herbage strown
> That just divides the desert from the sown."

The book is profoundly interesting. It appeals not alone to those whose concern is with geological, zoological, and allied problems, but to a much wider circle, including students of ancient civilizations and all connected with the development of the fertile regions of West Africa. M. Chudeau combats the belief, widely held, and with apparent reason, that the Sahara is encroaching upon the rich lands of the Sudan. Admitting recent instances of encroachment in the border zone, he maintains that a fuller examination of the evidence—notably that afforded by the ergs and the hydrographic system—will demonstrate, in all probability, that there has been no notable change in the area of the desert, merely an alteration in its position—that at an undetermined period of the Quarternary the Sahara must have occupied a more southerly situation than it does now. The present tendency is for the Sudan to encroach upon the Sahara. The author makes out a good case for his contention. The importance of the question as bearing on the future of Nigeria and French West Africa need not be insisted upon. A point made by M. Chudeau is, that in the border zone, notably in the region between the Niger and Zinder, land now barren would become fertile if cultivated. The security of tenure which should follow the establishment of French and British authority in that district may be expected to result in large areas becoming the homes of a sedentary population.

We have dealt with this subject first because of its bearing on the future of West Africa. Taking the chapters in order, the author begins with a sketch of the geological structure of the central regions of the Sahara, and then describes those regions in some detail—the Ahaggar (Hoggar), the Adrar of the Iforas, Adrar Tigirirt, and Air (Asbin). In the second chapter the same order is maintained in dealing with the border zone, which M. Chudeau calls "the high plains of the Sudan." Chapter iii. is devoted to meteorology, with the subdivisions climate and fog; chapter iv. to botany and zoology, including man. The three following chapters deal with the ancient hydrography, the fossil dunes, and various technical questions. It is impossible, within the limits of our space, to do more than indicate some striking points in the narrative, which is written with admirable lucidity. The account of the villages in the Ahaggar, where in an area one-fourth the size of France there is a population of some 6000, is to us quite new. These villages are not in oases, but are built on the sides of mountains nearly 7000 feet above the sea. The life of the Saharan farmers appears to be a hard one, but their numbers are slowly increasing. Several villages have been recently formed. The description of the fogs of the Sahara is vivid; besides the ordinary mirage-producing fog, dense fog is caused in the southern districts by the suspension in the air of impalpable particles of white clay. The grotesque shape often taken by these clay fogs is illustrated by several figures. The bold attempt to reconstruct the ancient hydrographic system can be outlined only in part. Its chief features are that (1) "The middle Niger seems to have had no past—it scarcely has a present;" (2) the Shari did not end in Lake Chad, but, by way of the Bahr-el-Ghazal, passed between Tibesti and Ennedi (Endi), and ended in some *shat* in the Libyan desert. That it may have reached the Nile is an hypothesis not absolutely rejected. With regard to the Niger, M. Chudeau shares M. Gautier's belief that the present upper river once ended in the Juf. At that time the river Taffassasset, coming from the southern versant of the Ahaggar and passing by Air, entered the Atlantic through what is now the lower Niger. The basin of Timbuktu was then (in the Quarternary age) a sea connected with the Atlantic; the sea in time became a closed lacustrine basin. The Juf having turned into a desert, the Niger was captured by the lakes and its course turned east; eventually the closed basin of Ansongo, which intervened between that of the Taffassasset and the new Niger, was breached and the

great river formed as we know it to-day. To follow M. Chudeau as he builds up his case is like following the plot of a detective story. It pieces together admirably.

In a chapter headed "Commerce," the author deals with the economic crisis caused in the Sahara by the suppression of the slave trade and the gradual supersession of its salt by cheaper stuff imported from Europe. The caravan trade to Timbuktu, he notes, has been killed by the competition of the Senegal-Niger railway; further east caravans can yet hold their own. A trans-Saharan railway, if ever built, must go towards Bornu to be of any economic value. In closing this inadequate notice, mention must be made of the many fine photographs given, the numerous plans and figures, and the coloured geological map. There is also an index (somewhat rudimentary, but welcome in a French work) to this and to M. Gautier's volume.

F. R. C.

'Le Cap de Bonne-Espérance au XVII^{e} Siècle.' By H. Dehérain. (Paris: Hachette. 1909. Pp. vi., 256. *Maps.* 3 *fr.* 50 *c.*) The author of this volume has already made excursions into the history of the white man's settlement of Africa. He now traces the early history of the Cape from the first settlement by the Dutch. The work is full of detail, has copious references to original authorities, and must be an important contribution to the literature on the subject.

'South Africa' ("Romance of Empire" Series). By Ian D. Colvin. (London: Jack. 1909. Pp. xiii., 328. *Map and Illustrations.* 6*s.*) The nature of this series demands that the present volume should be less of a continuous history than a selection of events in which the element of romance is conspicuous. Nevertheless, it appears to be a more serious study of its subject than other volumes in the series which have come under notice. It is well written, with much lively imagery, which must stimulate interest in this hardly won part of the empire. The illustrations possess the same quality of imagination, perhaps less admirably exercised.

'Travels in the Upper Egyptian Deserts.' By A. E. P. Weigall. (Edinburgh: Blackwood. 1909. Pp. xiv., 193. *Illustrations.* 7*s.* 6*d.*) This is an interesting book, containing a sufficiency of travel narrative to attract the general reader, and some study of ancient sites set forth with an authority (the writer being chief inspector for the Department of Antiquities) which will commend it to antiquarians. The book is beautifully illustrated, and the author's descriptive passages are inspired with his intense admiration for the scenery of the desert. His book is to be commended to all who are interested in Egypt and its antiquities.

AMERICA.

The Conquest of Mexico.

'The True History of the Conquest of New Spain.' Vol. 1. By Bernal Diaz del Castillo, one of its Conquerors. Translated with Introduction and Notes by Alfred Percival Maudslay, M.A. London: Hakluyt Society. 1909.

The history of the exploits of Cortez in Mexico rests upon the narrative of Bernal Diaz, that stout old soldier, who described what he saw with absolute fidelity because he had not the wit or the literary skill to embellish his tale. His account of the expedition lay for many years in manuscript, and when at last it was printed in 1632, the editor, Friar Alonzo Remon, unblushingly mutilated the text by suppressing and altering important parts of the narrative. Fortunately, the original manuscript had been preserved among the municipal archives in Guatemala, and

Señor don Gerarro Garçia was able to print it verbatim. It is from this version that Mr. Maudslay has made his translation for the Hakluyt Society.

There was a peculiar fitness in the choice of a translator. Mr. Maudslay has spent the greater part of his life in the study of the archæology of Central America, and his identification of the places referred to in the text—particularly those now embraced by the modern city of Mexico—may be accepted without hesitation. Of the narrative itself it is enough to say that those who know their Prescott must not be content until they have read his principal authority, and that those who have read Bernal Diaz will not need to read Prescott at all, so vivid are the pictures, so instinct with the sense of romance is the story unfolded to us by this simple old soldier. Much of the effect depends upon the style of the translation, and so far as it is possible to embalm the spirit of sixteenth-century Spanish in modern English, Mr. Maudslay has succeeded to admiration. Take, for example, Diaz' artless description of the Mexican priests: "These priests wore black cloaks like cassocks, and long gowns reaching to their feet, and some had hoods like those worn by canons, and others had smaller hoods like those worn by Dominicans, and they wore their hair very long, down to the waist, with some even reaching down to the feet, covered with blood, and so matted together that it could not be separated; and their ears were cut to pieces by way of sacrifice, and they stank like sulphur, and they had another bad smell like carrion."

The present volume carries us to the point of the advance upon Mexico City after the Spaniards had sighted it from the heights of Popocatapetl. The most exciting part of the narrative is therefore still to come. The work, illustrated as it is with copious notes and coloured reproductions of ancient documents, is one of the most important ever issued by the Hakluyt Society.

B. T.

'Handbook of Alaska.' By Major-General A. W. Greely. (London: Fisher Unwin. 1909. Pp. xiii., 280. *Maps and Illustrations.* 8*s.* 6*d.*) This volume presents in compact form a guide to the physiography and economic conditions of Alaska. The author is well qualified for his subject, through both official connection with and wide travel in the country. Out of an interesting and valuable work one may select the study of volcanic phenomena (especially those of recent occurrence), and the author's strong views on the native question and the attitude of the Government towards it, as points worthy of special notice. The maps and illustrations are alike excellent.

'Stanford's Compendium of Geography and Travel. Central and South America.' Vol. 1 (second edition). By A. H. Keane; edited by Sir C. R. Markham. (London: Stanford. 1909. Pp. xxvi., 611. *Maps and Illustrations.* 15*s.*) A considerable amount of revision has been necessary to this new edition. Knowledge of the great untravelled areas of the South American continent (with which this volume deals) has been gradually extended; there have been several important frontier settlements, and so forth. The European colonies of the Guianas have, in this edition, been grouped with Central America, so that this volume deals exclusively with the independent republics. It bears the same evidence of careful arrangement and accuracy as the rest of the series.

'Chile: a Handbook compiled by the International Bureau of American Republics.' (Washington, D.C. [*N.d.*] Pp. 236. *Map and Illustrations.* $1.) This is a remarkably cheap volume at the price. It is very well got up, and its ten chapters treat systematically and comprehensively of the geography, climatology, biology, political and economic conditions of the country. The excellent

photographs illustrate equally well the scenery of the country and the high architectural standard of public buildings in some of the chief towns.

'A Trip into the Interior of Peru.' By the Rev. A. Miles Moss. (Lima: Southwell. 1909. Pp. 42, 120. *Map and Illustrations.*) This volume contains a brief text in English and Spanish, in the form of an amplified diary. But it is chiefly remarkable for its photographs, which fill the whole of the 120 pages in the second counting, and include numerous really beautiful landscapes and a number of interesting studies of Indian types. On p. 21 is a particularly fine example of bowed strata.

AUSTRALASIA AND PACIFIC ISLANDS.

Australian Meteorology.

Solar Physics Committee: 'A Discussion of Australian Meteorology.' By Dr. W. J. S. Lockyer. London: Wyman. 1909. 5*s*.

Under the above title a valuable contribution to meteorology has been made by Dr. J. S. Lockyer, of the Solar Physics Observatory. In a series of communications to the Royal Society, Dr. Lockyer and Sir Norman Lockyer have pointed out the existence of a barometric see-saw having a period of 3·8 years, and being of world-wide extent. It has also been shown that the pressure changes occurring from year to year in Australia are closely similar to those taking place in India, but that the mean amplitude of the Australian variation, amounting to nearly 85 per cent. of the mean annual variation, is nearly double that of the Indian change. Another pressure variation in operation in Australia takes about nineteen years to complete a cycle, and has an amplitude nearly 25 per cent. of the annual variation. These Australian pressure changes, being of such large amplitude, must play an important part in bringing about changes experienced in the weather from year to year.

Australian weather itself appears to be the product of a series of anticyclones moving west to east at an average rate of about 400 miles a day, and following one another with remarkable regularity. About forty-two pass over the continent in the course of a year, and the average time of transit over any place is given as 8·7 days. From a study of South American and South African records there is evidence that the anticyclones travel completely round the Earth as individual systems, although subject to local modifications. In the Australian summer months (October to March) the mean latitude of the paths of the anticyclones is about 37° to 38° S. During this time Southern Australia is more or less dry, the southern depressions being too far out at sea to bring much rain; whilst Northern Australia, lying during this season beneath the vertical sun, gets "monsoonal" rains. In the winter months (April to September), on the other hand, the mean latitude of the paths of the anticyclones is lower—about 29° to 32° S., with the result that while Northern Australia is usually dry, the southern portion of the continent coming under the influence of V-shaped depressions gets frequent rain. The low-pressure systems exhibit a tendency to wedge themselves in between the anticyclones both to the north and south. From the curves of twenty well-scattered stations it is found that the pressure changes occurring from year to year are general, and that simultaneous excess of high or low pressure in any one year is a marked feature of the whole of the Australian continent. Years of exceptionally high or low pressure in Australia are due to anomalies in the condition or movement of the anticyclones. Years of high atmospheric pressure are found from a study of curves to be years of low rainfall, and *vice versâ*; this is a natural, though by no means a necessary, relation. Years of high atmospheric pressure are characterized by an increased frequency of "southerly busters." Not only does the rainfall

variation agree with the pressure variation as regards the 3·8-year cycle, but also to a fairly well-defined extent as regards the 19-year period. The changes of pressure occurring from year to year in Australia are closely related with those in India, which are the inverse of those taking place in South America. In connection with the barometric see-saw of 3·8 years, the two centres of inverse pressure type seem to be about Cordoba, in South America, and Bombay. The South American type of variation is closely associated with changes going on in the United States, Central America, North-West Africa, and Honolulu; whilst the Indian type is associated with those taking place in Europe, North-East and South Africa, Arabia, East Indies, and Australia. As regards the 19-year period, there is a time difference of phase amounting to about six years between South America and Australia. In other words, the Australian maxima do not, as in the case of the 3·8-year period, occur simultaneously with the South American minima. This fact may prove useful in long-period weather forecasting in Australia. The pressure curves for India reveal what has been discovered before, namely, that atmospheric pressure variation is related to the sun-spot period of eleven years, years of increased solar activity being years of reduced pressure in India consequent upon increased heat. It is, of course, just in large tropical countries like India that the direct effects of increased solar activity—increase of temperature causing decrease of pressure and increase of rainfall—will be manifested if anywhere. In higher latitudes any direct effects of increased solar activity are far more likely to be masked; for although an extra amount of heat from the sun must necessarily cause a differential rise of temperature over the whole Earth, nevertheless the net result in any particular region situated in a higher latitude might be, for instance, a cool summer in a sunspot year due to increased frequency of polar winds caused by the undue excess of temperature and deficit of pressure in lower latitudes.

L. C. W. B.

'The Dominion of New Zealand' ("All Red" Series). By Sir A. P. Douglas. (London: Pitman. 1909. Pp. xix., 444. *Map and Illustrations.* 7*s.* 6*d.*) This volume worthily upholds the promise of the series as regards matter, being attractively written and remarkably comprehensive. The map and the illustrations are quite good, but the binding and appearance of the book is less creditable, and some misprints may be detected.

POLAR REGIONS.

Baron Toll's Last Expedition.

'Die Russische Polarfahrt der *Sarja*, 1900–1902, aus den hinterlassenen Tagebüchern von Baron Eduard von Toll herausgegeben von Baronin Emmy von Toll.' Berlin: Druck und Verlag von Georg Reimer. 1909. Pp. 635. *Price* 14*m.*

In 1805, Sannikof, a mammoth bone collector, saw from the northern point of Kotelni island four mountains, and his observation was subsequently confirmed. The following year from New Siberia island he sighted another land towards the N.N.E., which was afterwards named by De Long Bennet Land. It was to establish beyond doubt the existence of these islands that Baron von Toll organized an expedition in a Norwegian whaler, refitted and re-named the *Zarya*. The chief results of his discoveries were published some years ago in this and other geographical publications, and this book is of interest as containing the detailed account of the progress of the expedition in the words of the leader and his companions. Passing through the Kara sea, the *Zarya* was frozen in at the end of September, 1900, in a small bay off Fram sound in lat. 76° 8′ 3″ and long. 95° 6′ 5″ E., whence sledge excursions were made to Taimyr bay, which proved to have only half the breadth

assigned to it by Nansen, and to be a typical fiord, and also to the Cheliuskin peninsula.' The vessel was not released till August 25, 1901, and meeting with a contrary wind on the east coast of Taimyr, which Baron von Toll had wished to explore, was steered towards Bennet island, and Cape Emma, the south-western extremity of Bennet island, was sighted, but ice and fog prevented a closer approach. On September 24, 1901, the *Zarya* was frozen in for the second winter in Nerpalakh bay, on the west coast of Kotelni island, and in the beginning of June, Baron von Toll, accompanied by Seeberg, astronomer and magnetologist of the expedition, and two men, set out to travel to Bennet Land by sledge and boat. They were never seen again, but in August, 1903, Lieut. Kolchak visited Bennet Land and found there Baron von Toll's diary, a sketch-map of the island, and a description which has been already noticed in this *Journal*. Of this sketch and description, facsimile reproductions are appended to the volume. Baron Toll wrote that his party intended to set off southwards November 8, 1802, and as no traces of them have been found on the coast of Siberia or even in Franz Josef Land, it is to be concluded that they perished at sea. The scientific observations and biological collections are being worked up by various specialists, and some sections of the results are now ready for press.

In a concluding chapter, M. K. Vollossovich contributes a general survey of the scientific work of Baron Toll, and of the geological result of his last expedition. During his former visits to the New Siberia islands, Baron Toll had ascertained that they are geologically a continuation of the Verkhoyansk mountains, and in his last expedition he found they had many features in common with these mountains, but still more with the coast region west of the Lena. According to the accounts of Baron Toll and A. Kolchak, Bennet Land is a high plateau rising like a huge pillar from the waves. It is built up of older Cambrian and Lower Silurian strata with graptolites, and therefore appears to be a direct continuation of the central Siberian plateau. Basalts and liparites intersect the mass, the former covering coal-bearing slates similar to those found in New Siberia, and the liparite is identical with that on the Balytakh, so that it cannot be of later than Pliocene age, and probably these latest eruptive rocks of Siberia may be assigned to the end of the Tertiary period, and it may be assumed that the tremendous vertical disturbances of the continent during this period contributed to the glaciation of the ocean by cutting off warm equatorial currents.

GENERAL.

Stanley's Autobiography.

'The Autobiography of Sir Henry Morton Stanley, G.C.B.' Edited by his wife, Dorothy Stanley. Sampson Low, Marston & Co. 1909. 21*s. net.*

This is probably the most interesting book that Stanley ever wrote, so far as all the purely autobiographical portion of the book is concerned—in other words, more than three-quarters of the work under review. There is no question of "wading" through this book; one flies through it, and returns to read and re-read the more vivid portions. And here it must be said that Lady Stanley has done her editing in the most judicious and catholic manner possible. She never once stands between Stanley and the reader, but assumes rather the attitude of an attendant at the side of the proscenium who from time to time raises and lowers the curtain.

Perhaps the book is not very appropriate for review in the pages of the *Geographical Journal*, as it may seem at first that the geography in it is already known or is out of date, and that Stanley in his last great work has been able to add but little to the enormous score he had already piled up of geographical revelations. But perhaps because Stanley was twice a medallist of the Royal Geographical

Society, members of that body may, by reading this book, care to know more than they have ever known before about this remarkable Welshman, the St. George who gave the *coup de grâce* to the Dragon of African obscurity. As we recede more and more from the perspective of the nineteenth century, so Stanley's figure will rise in proportion higher and higher amongst the crowd of nineteenth-century heroes. The more we come to know Africa, the more we shall be penetrated with a sense of the unique courage and determination which enabled this man to do what at that time was inconceivably difficult—to pierce a way down the unknown Congo, past the long course of rapids known as the Stanley falls, to navigate 1000 miles of unknown, cannibal-dominated river, and emerge again after an even more trying 100 miles of cataracts into the long estuary of the Congo.

The autobiography covering Stanley's life, from his first hours of consciousness in a cottage facing Denbigh castle to his starting on the search for Livingstone, deserves to take rank with 'Gil Blas,' with Dana's 'Before the Mast,' Mark Twain's 'Tom Sawyer' and 'Huckleberry Finn,' and some of Dickens's work, with here and there a Rabelaisian touch, which, however, has nothing nasty about it. The description of New Orleans in the fifties of the last century is a pen-picture of crudities written by a pure-minded person. Stanley's descriptions of the actual fighting between the Northern and the Southern forces (he was impressed as a volunteer on behalf of the South, and then several years afterwards served in the marine of the North) is one of the most graphic descriptions the reviewer has ever read of an actual battle in more or less modern times between contending white men. Equally graphic, but more horrible, is the description of the prisoners' camp near Chicago, in which the wretched war-captives rotted away by hundreds with preventable disease (though Stanley is careful to point out that prisoners taken from the Northern army suffered equal horrors in their Southern captivity). It was still an ignorant and a fierce-minded time, though there is many a touch of tenderness, and even sweetness, given in his pen-portraits of the American soldiers in both armies.

His descriptions of Livingstone [added to his original work on that subject by reference to note-books and conversations] are of the greatest interest, and almost deserve to be gathered up and printed separately as a kind of addition to the extant biographies of Livingstone.

Yet to those who expected no more staggering revelations of African wonders the book is of great geographical interest, as it teems with excellent and graphic descriptions of countries so well known that they have never been properly described. The writer of this review appreciates to the full the continual word-pictures given by Stanley (from memory) of the scenery of the Southern States of America, through which he passed as a soldier in the "Dixie Greys." He noted the dreamy and the sumptuously beautiful pine forests found in the relatively flat lands which lie between the great Alleghany chain of mountains on the north and the swampy semi-tropical country along the southern seaboard; he bows his head before the majesty of the 200-feet-high magnolias, and revels in the blaze of colour from the autumn foliage of liquidambars, live oaks, maples, and hickories. If he could be recalled and questioned, he would probably agree that some of the loveliest scenery of the United States may be located in Arkansas, in Eastern Texas, in Louisiana, Alabama above all, Southern Georgia, and Northern Florida.

Here is an impression, jotted down some time after he had come to rest in England, of the river Severn: "I saw the largest river in England yesterday; it appeared to be a little wider than what I could hop over with a pole in my best days. It was a dirty, rusty-coloured stream, but the meadows were fat. The country seems to perspire under its covering of leafy verdure. I always loved the

English country, and my secret attachment for it seemed to me well confirmed to-day as I thrilled with admiration and affection for all I saw. . . . On reaching London, compare the sad-looking streets which you look down upon from the lofty railway with the bright Paris you left in the morning. You may compare the one to a weeping widow, the other to a gay bride; or to a slatternly fish-woman and a neat grisette. . . . France and Italy shine with whiteness, Britain appears in a half cleaned-up state after being drenched with soot; its sky seems more threatening, and though the leafage and grass and the trees are pleasantly green, the stems and twigs are exceedingly black. The white cottages with red tiles of France are more beautiful than the dingy brick and dark slate of England."

There is an interesting statement on p. 538 of what Stanley would have done had he been in Gordon's place in 1884. "I would have lived, if only to get the better of the Mahdi; with joy of striving and fierce delight of thwarting, I should have dogged and harassed the Mahdi like Nemesis till I had him down." He would, in short, either have retreated whilst there was time to Berber, or have forestalled Emin Pasha by carrying himself and the pick of his garrison in his steamers up the Nile to the equatorial regions, whence he would easily have got in touch with Great Britain through Uganda. There is also a passage on p. 537 which gives his opinion on the trend of the Congo Government since the early nineties.

H. H. JOHNSTON.

TEXT-BOOKS.

'The Oxford Geographies.' Edited by A. J. Herbertson. (Oxford: Clarendon Press. 1909.) (*a*) 'The Elementary Geography,' vol. 1. 'A First Physiography.' By F. D. Herbertson, B.A. (Pp. 79. 13 *Illustrations*. 10*d*.) Great care has been used in putting the matter into suitable form, and the illustrations are admirably chosen. The book should be stimulating to teachers who have to teach young children. It is doubtful if it could be put into the hands of children who could not already read fluently, for some of the ideas are advanced. The same criticism applies to the excellent illustrations, which require an examination and analysis few children would be capable of giving. In the hands of an able teacher, much could be accomplished in preparatory forms of schools of the higher grade.

(*b*) The same. Vol. 2. 'In and about our Islands.' (Pp. 112. 1*s*.) Vol. 3. 'Europe.' (Pp. 111. *Illustrations and Maps*. 1*s*.) By the same author. These volumes have all the merits of vol. 1, and, with the exercises which are essential to their successful use, make excellent text-books. One wonders why the structure of Europe as a whole receives no separate treatment, since vol. 3 presents the first continental study in this series, and would be taken about two years after vol. 1. Further, a suggestion that North America be the first continent studied, which appears to be made by the arrangement of the subject-matter in 'The Preliminary Geography,' is not upheld in this series, which has apparently the same source.

(*c*) 'The Practical Geography.' Part II. By J. F. Unstead. (Pp. 112. 1*s*. 6*d*.) A very useful collection of exercises of a more advanced kind. The exercises devoted to the principal countries will serve to give a reality to the statements of any text-book, and the suggestive comparative exercises should result in further recourse to annually published statistics. For such work a teacher might divide a class into groups to deal with different sets of figures relating to a region. The results should be gathered up in a general report at which the whole class is present. Care should be taken to guard against the exercise being the sole end in view instead of illustrating some topic of the geographical course on which the class is engaged.

'Practical Modern Geographies.' Macmillan & Co. 1909. (*a*) 'Practical Exercises in Geography.' By B. C. Wallis. (2*s*. 6*d*.) A useful collection of practical exercises and examination questions, with many tables, graphs, diagrams, and pictures from which a teacher might well make a selection. The author has used the book as it is for a two years' course, centred apparently round the British Isles and the North Atlantic ocean respectively.

(*b*) 'A Geography of the British Isles.' By A. Morley Davies. (3*s*.) Emphasizes the importance, as far as possible, of first-hand evidence in the class-room, and endeavours to impress the importance of the two natural methods of land division by river-basins and by geological formations. The aim is well carried out, and the book is recommended to teachers interested in such a method, which makes for self-reliance on the part of the children.

'A General Geography of the World.' By Henry E. Evans, B.A. (Blackie & Son. 1909. Pp. 414. *Index and Appendices*. 3*s*. 6*d*.) A book full of facts collected for preparation for examinations. No light task is involved in its compilation, and it fully needs the amplification the author suggests.

'The New Outlook Geography.' (Harrap & Co. 1909. 1*s*. 6*d*.) Book i., "How People Live." By W. C. Brown and C. H. Johnson. The authors have endeavoured to frame a first text-book for town schools for boys of nine to eleven. The book might well find a place in such schools, for it is suggestive in method, and unsuitable exercises or questions can be omitted, as they are subsidiary to the main issue—geography from the human standpoint first.

'A Scientific Geography.' Book vii. "British Empire." By Ellis W. Heaton, B.SC., F.G.S. (London: Ralph, Holland & Co. 1909. Pp. 243. 2*s*. *net*.) Others of this series have already been noticed in the *Journal*. The arrangement of this, the last, volume necessitates much repetition which needs suppression, and it is unfortunate that the districts should receive two somewhat incomplete treatments, for it is not likely to aid the student in the preparation for the examinations for which the book is written. Some obvious "printer's errors" have been passed, and the treatment of climatic factors is in places not too clear. In the maps and diagrams lies the real merit of the book for examination purposes, and the author may have intended the text to merely supplement these. Reference to other volumes is a doubtful method of treating fundamental principles, and inadequate in the case of "The British Isles," unless a statement to that effect is included in the title. To treat of the British Empire in a volume of this size and type is a most difficult undertaking, which the above remarks emphasize without denying a considerable ability to the attempt.

'The British Isles. Practical and Economic Geography. By C. A. Wood, M.A., F.G.S. (London: The Normal Press. 1909. 1*s*. 6*d*. *net*.) This book is a summary of statistics and geographical facts for examination purposes. The diagrams and maps are devised to this end. Some revision is needed, particularly in the section dealing with railways. Much information is compressed within a small compass.

'Africa and Australia.' By Miss J. B. Reynolds. (A. & C. Black. Pp. 128. 81 *Maps, Diagrams, and Illustrations*. 2*s*.) The text is clear, and with the illustrations gives a concise account, based upon good methods of classification, of the subject-matter. It should be most useful as a first text-book leading to a comparison of these two southern land masses where it applies.

F. G. A.

'A Modern Geography for Irish Intermediate Schools.' By J. H. Cousins. (Dublin: Maunsell. 1909. Pp. xiv., 158. *Maps and Diagrams*. 1*s*. 6*d*.) This is a geography of the world, but, being designed for Irish uses, it deals with that country

in some detail. In style it is pleasantly free from the oppressiveness characteristic of many school geographies, and, while possessing no distinguishing features, its matter seems sound and well arranged. The sketch-maps and diagrams are of poor appearance, and some are almost too rough and generalized to be of value.

'A Systematic Geography of the British Isles.' By G. W. Webb. (London: Methuen. 1909. Pp. viii., 94. *Maps and Diagrams.* 1*s.*) This is the first volume of a series of five which is to cover the whole world. Its aim is "to present in a clear and logical manner the salient points in the geography of the British Isles." It does so in a rather formal and tabular manner, which could hardly but repel the student if he were dependent on this volume alone; but if read in conjunction with other branches of geographical study of greater natural interest, it should prove useful.

'By Road and River.' By E. M. Wilmot-Buxton. (London: Methuen. 1909. Pp. viii., 154. *Maps and Illustrations.* 2*s.*) In view of the title, the sub-title of this book is somewhat unexpected—'A Descriptive Geography of the British Isles.' It is an attempt, and should be a successful attempt, to render geography palatable by guiding the learner on imaginary journeys through his own land. The use of such a method within so small a compass makes the text somewhat "sketchy," but all the information given is worth having. The maps are above the average.

'A Scientific Geography. Book vi. Asia.' By Ellis W. Heaton. (London: Ralph, Holland. 1909. Pp. 148. *Maps and Diagrams.* 1*s.* 6*d.*) We have here another volume of concentrated geographical teaching, but the author fortunately does not err in the direction of tabulation or other forbidding features which are common in such works. His style ought not to fail to interest the student, and the information contained in the volume is comprehensive. An index is lacking.

O. J. R. H.

THE MONTHLY RECORD.

EUROPE.

The Purpose of Deneholes.—The Rev. J. W. Hayes contributes a lengthy article to the *Journal of the Royal Anthropological Institute* (vol 39, p. 44, 1909) on the subject of deneholes in the home counties and elsewhere, and considers the evidence in support of the large number of theories that have been advanced to account for their existence. The etymology of the word "dene" indicates its derivation from an Anglo-Saxon word signifying a depression, cave, den, or hole, "dene" being used with "hole," as a double name, in the same way as "river" is used with "Avon" and "Ouse," both of which words signify river or running water. Of ten theories concerning the purposes of deneholes struggling for recognition there is only one, according to Mr. Hayes, which satisfies the laws of evidence, and that is that these excavations are simply "chalk pits," "chalk wells," or "chalk quarries," and not granaries, hiding-places, burial-places, etc. The fact of chalk being dug for, often through 60 feet of superimposed strata, instead of being quarried at the surface in chalky districts, need cause no wonder, inasmuch as surface chalk is impure and unfit for building-blocks or for making lime, whereas good block chalk in a dense pure condition is best obtained under great masses of sand, such as are found at Hangman's Wood, Abbey Wood, Bexley, Swanscombe, Purfleet Hill, and various other places. As for the Chislehurst caves, they may be old, but there is nothing to favour the view of their mysterious origin. They are simply old chalk workings. The evidence of men who have worked in the caves goes to show that half a

century ago chalk was still extensively obtained from these workings, and used by farmers as a dressing or manure for poor soils in the days when manure was scarcer than now, and the demand for chalk dressing proportionately greater.

Navigation of the Rhone.—An article by P. Frécon in the *Bulletin de la Société de Géographie de Lyon* (2e Série, 1909) discusses the question of the navigation of the Rhone and the project of a lateral canal. Admitting the desirability of an increase in the ways of communication in the Rhone valley, the writer does not look for a revolution in the economics of France from its realization. Comparing, too, the costs and services of water- and rail-way respectively, he decidedly prefers the latter, and notes methods of utilizing the Rhone, independent of navigation. Since the latter half of last century, the Rhone is one of the best navigable highways of Europe. Whereas it has almost always a minimum depth of 4·6 feet, the Elbe has this for 200 days, the Vistula for 155, the Oder for 127 only. The total tonnage floated by the Rhone amounts to 300,000 as against 440,000, exclusive of coals, circulating in the waterways between the English channel, the Belgian canals, and Paris. The volume of the Rhone-borne trade can never, however, by any engineering application, compete with that of the Rhine-borne trade, seeing the agricultural valley of the Rhone is not to be transformed into an industrial valley. The rivalry of Genoa is not due to its better communications. The St. Gotthard tunnel wrested much trade from Marseilles, and now the St. Gotthard, in turn, is suffering from the competition of the Simplon. A tendency to shift eastwards is notable in the current of international traffic. Genoa and Brindisi are in their turn threatened by Saloniki. Busied with the advancement of her communications with Macedonia, Austria-Hungary recognizes how the improvement of this port would attract to its lines the traffic of Central Europe. The north of France should gain from the opening of the Simplon; its more westerly position, as compared with the St. Gotthard, gives France the opportunity of recovering part of the merchandise and passengers lately diverted elsewhere.

A Morphological Study in Württemberg.—A recent issue of the *Forschungen zur Deutschen Landes- und Volkskunde* (18, Heft 4) presents an interesting study of the physical development of the step-landscape, by which the Swabian Alb falls in a north-westerly direction towards the basin of the Neckar in Württemberg. It is shown that, according to the now accepted ideas, this, like other step-landscapes, has been formed out of an original peneplain by the action of running water. The various stages in the development of the existing river-system are clearly traced by the author, who uses the terminology of Prof. W. M. Davis, and illustrates the processes by block diagrams such as have been used with so much effect by the latter writer, as well as by a map giving a diagrammatic view of the succession of steps. Various modifications of the drainage have taken place in the course of ages. The original consequent streams had a slope from north to south, cutting through the escarpments of the Lias and the White Jura formed by the action of their subsequent tributaries. Down to the deposit of the diluvium the district was drained by the Kocher and Jagst (now tributaries of the Neckar) towards the Danube, the water-parting coinciding roughly with the escarpment of the Keuper, the most northern of the three steps. Later, as a result of tectonic disturbances and the lowering of the base-level of erosion on the lower Neckar, a series of stream captures took place, the Jagst first overflowing into the Hohenlohe plain, while the Rems, Murr, Kocher, and Bühler were also in time diverted towards the Neckar. The old subsequent valleys are thus now drained in an inverse direction, and the map clearly shows how many of the minor tributary valleys, which have retained their primitive direction, point backwards towards the sources of the larger streams.

The Disaster to the Von Knebel Expedition in Iceland, July, 1907.—The tragic disappearance of Prof. von Knebel and his companion Rudloff, during an expedition to the Askja volcano in Iceland (*Journal*, vol. 30, p. 436) is still more or less of a mystery, but an attempt is made by Herr Krebs (*Deutsche Rundschau für Geographie*, vol. 31, part 12) to account for it as the result of a catastrophe brought about by seismic-volcanic disturbance. The writer points out that a world-shaking earthquake of some magnitude was recorded at European seismological stations on the very day (July 10) on which the disaster occurred. The area of maximum shock is placed somewhere in the region of the Philippine islands, and it is pointed out as a remarkable fact that in March, 1875, simultaneously with the greatest eruption of Askja known within historic times (an explosion comparable to that of Krakatau in 1883), a large area, also lying almost antipodal to Iceland, was similarly affected by severe seismic and volcanic disturbances. The neighbourhood of Iceland is, in fact, known to have been specially liable to such disturbances in July, 1907, for only two days before the catastrophe of the 10th the cable to Iceland had been broken—for the first time, apparently, since it had been laid down. The suggestion therefore is that, as a result of some seismic or volcanic disturbance, a landslip occurred on the precipitous shores of the Askja lake, by which the two German travellers (known to have been then navigating the lake) were overwhelmed. A similar explanation, though not based on the same line of reasoning, was suggested by Herr Erkes, the geologist who visited the scene of the disaster in 1908.

Hydrological Research in Italy.—An important organization for the collection and utilization of hydrological observations has lately been set on foot in Northern Italy, with Venice as its headquarters. By an Act passed on May 5, 1907, a special office was constituted, under the title "Magistrato alle Acque," with the task of generally supervising the waters of North-Eastern Italy and regulating them in the interests of forestry, hydraulic works, harbours, etc. The area under its control embraces the whole Venetian territory with a portion of the adjoining province of Mantua in Lombardy. The hydrological conditions within this area are somewhat exceptional, by reason of the torrential character of the rivers, which, descending rapidly from the mountains to the plain, being fed by a copious rainfall, and possessing no natural basins to regularize their flow, occasion frequent and disastrous floods. In order to create the organization necessary to carry out the proposed task, an "Ufficio Idrografico" was formed, and this issued its first annual report during 1909. The first step was the creation of five separate "services," dealing respectively with meteorology, rainfall observations, hydrometry, the prevision of floods, and tide-observations. The meteorological observatories already existing within the area have come into line with the new organization, and a scheme has been prepared for the correlation and systematization of the observations made throughout the area, under the direction of the observatory of the Patriarchal Seminary at Venice. Complete rainfall observations being of special importance for the objects in view, no fewer than 290 places have been selected as observing stations, the average distribution being at the rate of one to every 90 square kilometres of surface—a mean density which is certainly one of the highest in Europe. This is rendered advisable by the special conditions and the great variations of rainfall within the area dealt with. The hydrometric service will extend and systematize the measurements made in the past on various rivers, and three classes of observing stations will be maintained, according as the object is the prevision or regulation of floods, or merely the supply of a regular hydrometric record. Lastly, the Tidal Service will take over all the instruments and other equipment of the organization lately started by the Reale Istituto Veneto

for the study of the lagoon of Venice (cf. *Journal*, vol. **27**, p. 298), and will carry on a series of tidal observations, both on the outer coast and within the various lagoons. The work thus undertaken will be of great practical importance, and it is to be wished that the excellent example thus set might be widely followed.

AFRICA.

Terrestrial Refraction at Alexandria.—In the *Cairo Scientific Journal* Mr. C. Xydis gives the results of measurements upon terrestrial (atmospheric) refraction made by him at Ibrahimia. The measurements were obtained by making observations of the dip of the horizon from the terrace of his house, which is distant from the seashore 205 metres on the north and 320 on the west, the greater part of the line of sight thus lying over the sea. The altitude of the theodolite used was 20·68 metres, and the distance of the horizon thus approximately 17·5 kilometres. The range of the tide at Ibrahimia is about 60 centimetres, and this necessitates a correction of the calculated dip of the horizon for the tidal effect of $\pm 4''$, t being assumed that the rise of the tide on the open sea is the same as on the seashore. The true dip is given by the formula—

$$D_{true} = \text{cosec } 1'' \, (2h/R)^{\frac{1}{2}}$$

where D is the dip of the true horizon in seconds, h the altitude above the level of the sea, R the radius of curvature of the meridian for latitude 31° 13′, which is 6,352,300 metres with Clarke's figure of the Earth. The apparent horizon is approximately represented by the formula—

$$D_{app.} = \text{cosec } 1'' \, [2h(1-k)/R]^{\frac{1}{2}}$$

where k is the coefficient of refraction. From the measured dip of the horizon the value of k is derived, since all the other quantities are known. The following conclusions are drawn by Mr. Xydis from observations carried out in October, November, December, and January: (1) k is an almost constant quantity from 8 or 9 a.m. to 4 or 5 p.m.; (2) the refraction is practically the same, so far as the observations go, in both the observed directions (north and west); (3) k, which is usually positive, is at Ibrahimia in many cases negative, signifying that the line of sight is made convex downwards by the refractive action of the air. The usual of k was about 0·08, but during the khamsin days in February and March its value ranged from 0·40 to 0·58, represented by dips from 6′ 46″ to 5′ 5″. Mr. Xydis explains the small dips on khamsin days by the fact that on such occasions the air in contact with the sea is cooler—making the curve of the ray of light flatter than is usually the case. On five occasions a dip of the horizon of about 8′ 25″ at 1 p.m. was followed by either strong north-west wind or khamsin. In Egypt the refraction varies more than in European countries, and the physical explanation of the variability of k, found by Mr. Xydis, is to be sought in the rapid variation of the temperature gradient in the lowest strata of the atmosphere through which the line of sight passes.

Ptolemy's Knowledge of West Africa.—We have received from Captain R. Avelot the reprint of a paper contributed by him to the *Bulletin de Géographie Historique et Descriptive* (Nos. 1 and 2, 1908), under the title "L'Afrique Occidentale au temps des Antonins" (Paris, 1909). The writer justifies yet another disquisition on Ptolemy's geography on the ground that recent research in the Western Sudan, especially that of Lieut. Desplagnes as set forth in his book 'Le Plateau Central Nigérien' (cf. *Journal*, vol. **30**, p. 550), has for the first time supplied the necessary facts in regard to the region in question. He holds that there is ground for believing that the knowledge of the countries south of the Atlas

possessed by the Romans in the time of the Antonines was far more extensive than has sometimes been supposed, such knowledge being gained, not directly, but through the intermediary of enlightened natives. He examines in turn Ptolemy's nomenclature of the coast-line and the interior, and his accounts of the tribes of West Africa, endeavouring in each case to explain his statements by the aid of existing knowledge. The result is, in his view, to prove that the acquaintance of the Romans with West African geography and ethnology extended as far as a line running approximately from Sherbro island on the Atlantic to Say on the Niger. It cannot be denied that the identifications are generally such as to win confidence, and that a satisfactory agreement seems capable of being made out between Ptolemy's statements and the reality. Captain Avelot wisely abstains from basing arguments on mere similarity of names, though such similarity is often used as an additional support of conclusions arrived at on independent grounds. Thus the *Darad* (identified by C. Müller with the Draa) coincides, according to Captain Avelot's scheme, with the Senegal, and it is pointed out that the Wolofs of the present day know this river as the Ddar. Of other names mentioned in connection with the coast, Cape *Arsinarion* is Cape Verde, the *Nia*, the Gambia (a hill at the source of which is still known as Nia-kwa—"head of the Nia"), and so on. As regards the interior, the much-discussed question of the Nigir and its branches receives a new solution, its upper course being identified with an old drainage system now buried under the sands of the Sahara, but which is held to have formerly descended from the western Adrar towards the lacustrine basin of the Niger west of Timbuktu. Of the three great nations mentioned by Ptolemy in the northern part of the region, the "Black Getulians" were a branch of the Berbers of the west, "black" signifying merely that they belonged to the confederacy of which black was the national colour. The "Red Ethiopians" may well have been the Fulas, as has been generally thought, though the confederacy of the Reds included a great number of tribes. The "Ethiopians of the Nigir" (not black Ethiopians, which would have been a tautology) are considered to have been a congeries of Mandingo tribes. In accordance with these conclusions, Captain Avelot supposes that, except on the coast, where the Berbers reached down to the Senegal, the Negro domain extended much further north in Ptolemy's time than at the present day.

A Search for the "Bushmen's Paradise," German South-West Africa.—A minor piece of exploration of an interesting character was performed last February by Lieut. Trenk, who, encouraged by the favourable rainfall, set out from Sesrim (in the valley of the Tsaukhab, south of the Khuiseb) in search of the reported vley of Sossus, with which has been connected the legend of a "Bushmen's Paradise" in this part of the country (*Deutsches Kolonialblatt*, September 1, 1909). All attempts to reach Sossus had previously failed. The route led west down the dry valley of the Tsaukhab, which, after traversing a narrow gorge with perpendicular sides, widened out somewhat, and entered the belt of sand-dunes which here run regularly from north-west to south-east. The valley must once have been well covered by trees, which (now dead, except in the actual bed of the river) occupy most of its width for over 20 miles from Sesrim. Grass continued to occupy the river-bed for some miles further, but vegetation then entirely ceased until, on reaching Sossus, a number of green trees and bushes were found to cover the western side of a large vley, beyond which the river's course was entirely blocked by dunes. No water was to be seen, the bushmen fetching their supply from a point 12 miles up the river, or obtaining the necessary liquid from the succulent Nara plant (cf. *Journal*, vol. 32, p. 336). Between the dunes, the valley of the Tsaukhab is formed of the hard stony ground known as "Namib."

AMERICA.

Captain Bernier's Expedition in the Canadian Arctic Archipelago.—We have received a copy of the *Citizen* of Ottawa, October 18, 1909, containing the account of Captain Bernier's entertainment at luncheon by the Canadian Club on October 16, after his return from his northern voyage. From this it appears that the *Arctic* (formerly the *Gauss*) wintered on the coast of Melville island, which Captain Bernier described as a beautiful island, with thousands of musk-ox and reindeer, as well as wolves, foxes, and some bears and seals. The climate was wonderfully dry, and from April to July there was abundance of grass and flowers. He took the *Arctic* some 10 miles further, and then saw open water for another 20 miles, so that it would have been perfectly feasible to complete the north-west passage once more. The records left by Sir Edward Parry were found and brought back, as was also a pole used by Sir John Franklin. McClure's depôt was found despoiled of everything except some pieces of canvas and some coal. Formal possession of the whole archipelago, from 60° to 141° W., and up to 90° N., was taken, and this was recorded on a copper plate erected at the winter harbour on Melville island. Sir Wilfrid Laurier, who was present at the luncheon, expressed the hope that Captain Bernier would be ready to start again in 1910 with the same ship and crew, and promised that a free hand would be given him to go to whatever latitude he found possible.

Lake Ramparts in Minnesota.—We referred, in the *Journal* for August, 1908 (vol. **32**, p. 390), to Prof. Gilbert's discussion of the ramparts on lake-shores formed by the action of ice in pushing up the stones, etc., from the outer portion of the bottom. Attention has since been called, in a paper by Mr. R. F. Griggs in the *American Journal of Science* (May, 1909), to the frequent occurrence in Western Minnesota of lakes cut up into two or more portions by similar ramparts, forming long narrow barriers, sometimes extending from shore to shore. Reasons are given for believing that such barriers can have been formed by no other agent than ice, though it is allowed that its action can hardly have come into play unless there were shallow places in the beginning. Where lakes of large size have been divided by such barriers, the original irregularities may have been caused by lines of moraine crossing them. In many cases the barriers merely cut off small ponds or swamps by forming across shallow bays, and these can be accounted for by ice-action alone. Thus the final result is to accelerate the filling up the lake by the growth of vegetation in the shallow water, though primarily the tendency of the ice-pressure is to clean out the advancing vegetation and pile up steep banks. The remarkable character of the barriers described is well shown by photographs.

The Mapping of Colombia.—We have been favoured with the copy of a communication received at the Foreign Office, relating to the recent establishment of an "Office of Longitudes" at Bogotà. The office, which was created by Law No. 30, of 1909, dated October 11, and is placed under the Ministry of Foreign Affairs, is described as "a scientific centre for the systematic and progressive improvement of the general map of the Republic." It is provided that the National Astronomical Observatory shall give its assistance in connection with meridians which can be obtained by telegraph, in order that these may be referred to the meridian of the Observatory; the free use of the telegraph being accorded for this purpose. The instruments and other apparatus used by the Venezuelan Boundary Commission are to be handed over for the use of the new office. This new departure is a welcome step towards the provision of a trustworthy map of Colombia.

AUSTRALASIA AND PACIFIC ISLANDS.

Soundings by the "Planet" in the Western Pacific.—The work of the German Survey ship *Planet* has been continued during 1909, and besides the soundings in the neighbourhood of Bougainville referred to in the *Journal* for July last (vol. 34, p. 91), various other series have been obtained in the portion of the Western Pacific adjoining the German possessions in that region (*Annalen der Hydrographie*, 1909, Heft 8). Another sounding of over 6000 metres was obtained to the west of Bougainville, but as a part of the sounding-line, with the instrument attached, was lost, the exact depth was not ascertained. A number of soundings east of the Solomon islands show that the depth here is comparatively small, though the existence of a deeper channel of about 3000 metres between the islands and the reefs to the east seems established. The slight depths *between* the islands seem to point to their former connection, a state of things which contrasts with that in some of the Pacific groups, *e.g.* the Marshall islands. Among the later soundings was one of 7406 metres only 20 nautical miles to the south of New Pomerania (New Britain). This seems to confirm the existence of a very deep trough running from the west coast of Bougainville towards the south coast of New Pomerania.

The Rainfall of New Caledonia.—The above subject is dealt with in a pamphlet by Messrs. T. Mialaret and A. Fraysse, entitled 'Contribution à L'Étude du Climat de la Nouvelle-Caledonie' (La Pluie de 1903 à 1908). It is regrettable that meteorological observations for a long series of years (1860–1903) only exist for one station in the island, namely Noumea, inasmuch as differences of altitude and exposure cause considerable local variation of climate. So far as can be judged from five-year observations, there is much more rain on the east coast of the island than on the west. At Nouméa the rainy season begins about January, when the sun, after having reached its most southerly declination in December, again becomes vertical over the island, but, as in many tropical countries, there are large variations of rainfall from year to year. Torrential rainfalls are, as might be expected, of somewhat frequent occurrence, and the heaviest fall in twenty-four hours at Nouméa occurred on April 5, 1872, when 242·5 millimetres (9·5 inches) fell during a tempest. Although there is great mineral wealth in Caledonia, the prosperity of the colony must depend mainly upon agriculture, to which the warm climate, without extremes of temperature, and abundant rainfall, averaging about a metre (40 inches) a year, is eminently favourable. As is the case, however, with many of the Pacific islands, especially those parts of them sheltered by mountains from the action of trade winds, New Caledonia is liable to periods of drought which are very prejudicial to the interests of agriculture. The island of Hawai near the northern tropic is nearly symmetrically situated with regard to New Caledonia near the southern tropic, and although the rainfall is less than in New Caledonia, the effects of drought have been neutralized by a successful system of irrigation. Authorities consider that natural conditions favour irrigation work in New Caledonia also, and that it is a question of money whether the work can be undertaken.

POLAR REGIONS.

Honour to Commander Peary: Report on his Observations.—At the meeting of the National Geographic Society of Washington on December 15, a medal was awarded to Commander Peary for his attainment of the North Pole, and also a medal to Captain Bartlett, who, it will be remembered, accompanied him as far as 88° N. lat. The following Report of the Sub-Committee of the Research Committee of the National Geographic Society, on the Peary Expedition, has been forwarded to the Council by the Secretary of that Society: "The Sub-Committee

to which was referred the task of examining the records of Commander Peary in evidence of his having reached the North Pole beg to report that they have completed their task. Commander Peary has submitted to this Sub-Committee his original journal and records of observations, together with all of his instruments and apparatus and certain of the most important of the scientific results of his expedition. These have been carefully examined by your Sub-Committee, and they are unanimously of the opinion that Commander Peary reached the North Pole on April 6, 1909. They also feel warranted in stating that the organization, planning, and management of the expedition, its complete success and its scientific results, reflect the greatest credit on the ability of Commander Robert E. Peary, and render him worthy of the highest honours that the National Geographic Society can bestow upon him.—HENRY GANNETT, C. M. CHESTER, O. H. TITTMANN, Sub-Committee, Research Committee."

Captain Scott's Antarctic Expedition.—We are pleased to learn that progress continues to be made with the organization of Captain Scott's proposed South Polar Expedition. Dr. A. E. Wilson will once more accompany his old commander, occupying the position of chief of the scientific staff, with the special *rôle* of zoologist and artist. Among the three geologists who will, it is hoped, take part in the expedition is Dr. J. Mackintosh Bell, whose excellent work both on the Canadian Geological Survey and, more recently, as Director of the Geological Survey of New Zealand, is well known. Dr. Bell has volunteered his services, and will accompany the expedition if he obtains the necessary leave. Of the two physicists, one will be Dr. R. Simpson, of the Indian Survey Department, who is now on his way to England from India. Biology will be looked after by two if not three experts (who will be chosen for the special reference to their knowledge of marine biology), while a second doctor will share with Dr. Wilson the medical care of the party, besides undertaking research in botany and bacteriology. Another member of the expedition will be Mr. C. H. Meares, the late Mr. Brooke's companion during a part of his journeys in Western China (cf. Mr. Meares' article in the December number, p. 614). He will shortly leave England for Eastern Siberia in order to collect the necessary ponies and dogs, which will be sent from Vladivostok *viâ* Kobe to New Zealand, where Mr. Meares will himself join the expedition. Captain Scott gave up his work at the Admiralty early in December in order to devote his whole time to the expedition. Minor work on the *Terra Nova* has already been begun, and a motor sledge of improved pattern is being constructed.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Evaporation over Lakes and Reservoirs.—In the year 1907 there was carried out, in the neighbourhood of the Salton sea in Southern California and elsewhere in that region, an extensive research into the laws controlling the rate of evaporation in the open air over large lakes and reservoirs, with a view to arriving at some mathematical formula which should approximately represent the general law of evaporation. The U.S. Weather Bureau, the U.S. Reclamation Service, and the Water Resources Branches of the Geological Survey, co-operated to organize a simultaneous series of observations on the same plan at various places in the United States. Prof. Bigelow, who paid a visit of inspection to the observing stations, has set forth the results of the investigation in the Annual Summary of the *Monthly Weather Review* for 1908. Evaporation pans were used, together with such meteorological instruments like thermometers and psychrometers as the observations required, in three types of location, namely, a large water area, an irrigated field, and a dry area away from natural water or irrigated ground. As the result of

extensive computations upon the observations, it was decided to continue the researches with the aid of the following formula:—

$$E_0 = C_d \times 0{\cdot}100 \frac{e_s}{e_d} \cdot \frac{de}{ds}(1 + Aw)$$

where E_0 = the observed amount of evaporation per given time,

$\frac{e_s}{e_d}$ = expression for the vapour-pressure gradient,

$\frac{de}{ds}$ = rate of change of vapour-pressure in saturated condition, with temperature,

$(1 + Aw)$ = complication introduced by wind, w being the wind velocity,

and C_d = a coefficient containing thermodynamic constants, the evaporation interval of time, and some unknown function representing some physical process like diffusion which may influence the phenomenon of evaporation.

All these terms are determined by direct instrumental observation except the coefficient C_d, which can be secured, however, by a few days of observation at a given station. The coefficient C_d, which is, as intimated above, a variable, is simply the expression $\frac{E_0}{E_1 + E_1 Aw}$, E_0 being, as aforesaid, the amount of evaporation for a given interval, E_1 the computed or theoretical evaporation for the temperature conditions of the atmosphere per given time, and $E_1 Aw$ the wind effect; and its value is required to be established in many localities in order that a general evaporation formula, applicable under all conditions, may be arrived at. A knowledge of the C_d coefficient is extremely useful, as by it the amount of evaporation can be followed from the meteorological data more accurately than from the pan measurements, subject to all sorts of disturbing conditions.

Observations on Evaporation in the Atlantic Ocean.—Dr. Rudolf Lütgens, of Hamburg, has given in the *Annalen der Hydrographie und Maritimen Meteorologie* for 1909 (pp. 145–153) an account of scientific observations made during a voyage to the South Atlantic in 1908 (*Journal*, vol. 32, p. 536). The four-masted barque *Pangani* left Hamburg on September 12, and reached Valparaiso on December 15. The chief investigations carried out on board were those connected with evaporation and salinity, especially the former. The evaporation from the surface of the sea was obtained by the indirect method of determining the increase of salinity or salt-concentration of a quantity of sea-water placed in a vessel exposed to the air, the column of water evaporated being then easily obtained by calculation. Between lats. 40° N. and S., the mean 24-hourly amount of evaporation was 5·7 millimetres, but north and south of this zone only 3·2 millimetres. The maximum evaporation observed was in the Trade Wind regions in about 30° N. and 20° S., where it amounted to 7 or 8 millimetres. In the equatorial calm-belt the evaporation fell to about 4 millimetres, a fact easily accounted for by the high relative humidity of the air, the absence of wind, and the frequent cloudiness of the sky. The minimum daily evaporation of 2 millimetres was observed in the neighbourhood of Cape Horn, where the low temperature of air and water is clearly the cause of the small evaporation. After air and water temperature, a comparison of curves shows that wind is the most important factor influencing the rate of evaporation, but that the relative humidity of the air, as well as direct sunshine, also play, as one would expect, an important part. Both wind and sunshine, however, act by influencing the relative humidity of the air, the former by preventing saturation at a particular spot, the latter by raising the temperature of sea and the superincumbent air, which thus can take up more water-vapour. It is noteworthy in this connection that Dr. Mill's

evaporation experiments, conducted in a comparatively confined space at Camden Square, N.W., fail to show the relation between wind and evaporation. Since the amount of evaporation increases with the size of the evaporating vessel, it is important for comparative purposes to employ an evaporimeter of standard size. On board the *Pangani* the capacity was 2400 cubic centimetres, and an addition of 20 per cent. to the values obtained was considered by Dr. Lütgens to give an approximation to the actual evaporation over the surface of the ocean.

GENERAL.

Human Migrations.—Prof. G. F. Scott-Elliot, in a paper contributed to the *Transactions of the Dumfries and Galloway Natural History and Antiquarian Society*, gives a brief sketch of the course of human migrations, prehistoric and historic. Here reference is possible to only one or two of the indicated lines of migration. As in historic times the herdsmen of the Asiatic steppes, pressing northwards, forced other peoples towards Bering strait, so in prehistoric times must the Eskimo, driven into Asia's north-east corner, have been forced by them across the strait to the land looming in the distance. Next followed the ancestors of the American Indians, pressing the Eskimo into their present fastnesses. The main stream of new immigration, peopling the coast down to San Francisco, sent offshoots up the salmon rivers. Crossing the Rockies, these descended to live by hunting on the prairies. Growing more numerous, clans next pushed south by way of Mexico, Bogotá, and Peru, the old Inca highway crossing by Tucuman to Paraguay and the pampas. Hunting communities of superior vigour growing up in these pastures forced the Yaghan into the south-west of Tierra del Fuego. The jungle-forests of the Amazon, Gran Chaco, etc., are still the refuge of a miserable residuum. But how account for the flourishing states of ancient Mexico, Bogotá, and Peru, intersected by post-roads, irrigated from canals, glorified by temples? Had Asia any hand in such civilization? Attention is drawn to the similarity between the civilization of ancient China and that of ancient Peru, between the skull of the semi-civilized American and that of the Mongol (the Kurasiwo drift and Californian current might, it is suggested, bear Chinese and Japanese ships to American shores). Asia is taken as the starting-point of the South sea migrations. The Malay Mongol is tracked south-westwards. The Hovas of Madagascar, *e.g.*, are Malay immigrants of only three to four thousand years ago. Other migratory tracks include the line of the Siberian railway and that of the Cape-Cairo railway, with a western divergence at Khartum.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1909–1910.

First Meeting, November 8, 1909.—Major Leonard Darwin, President, in the Chair.

Elections.—*Lieut. Willoughby Clive Garsia (Hampshire Regiment); Glynne G. Griffith-Williams; Captain Ronald Macclesfield Heath; Jesse Herbert; Lieut. John Meredith Holton (Sussex Regiment); William M. King; Maurice Macmillan; Major Oswald C. Williamson, R.A.*

The paper read was:—

"Journeys in Bhutan." By J. Claude White, C.I.E.

Second Meeting, November 15, 1909.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*Reginald Akroyd; Rev. Joseph George Aldridge; Rev. Edward Arthur Aldridge; Fred. W. Ambrose; Lieut.-Colonel Arthur Fred. Appleton; Stephen Armitage, B.A.; Charles Robert J. Atkin-Swan, M.D.; Leon Aubert, B.A.; Frederick Robert Bader; Lindon Wallace Bates, C.E.; Walter Remington Bateson; Reginald Beddington; Hugh Massy Birch; J. Blum; Captain John Bois (King's Own Regiment); William Brettle; George Matthew Bridges; Rev. Augustus Briggs; Major Archie Stewart Buckle, R.A.; Thomas Carson; Douglas Carruthers; Edwin Herbert Cartwright; Julius Chambers; Captain J. R. Clarke (Norfolk Regiment); N. C. Cockburn; Robert E. Crane; J. P. Crommelin; Theophilus Clive Davies; Lieut. A. J. A. Douglas; St. Vincent Bowen Down; Lieut. W. D. Downes (Royal Sussex Regiment); James Alexander Duncan; Arthur Radcliffe Dugmore; Alexander Henderson Dunsmure; Frank Edgar; James Huston Edgar; Henry Gardiner Ferguson; George Vines Forrest; William Melville Foster; Hugh Moreton Frewen; Sydney Garne; Lieut. C. H. Gay, R.G.A.; Alfred Hamilton Grant, C.I.E.; J. H. Grieve; Arthur Groves; G. A. Hancock; Daniel Hanbury; Captain F. Hardy (Coldstream Guards); Captain F. de W. Harman (Norfolk Regiment); Robert Hawxhurst; George Evan Hesketh, M.A.; Edbert Ansgar Hewett; Paxton Hibben, M.A.; Captain C. C. H. Hogg, R.E.; William Hopkins; F. W. Leicester Hulk; Lieut. John Meredith Hulton (Sussex Regiment); Lyman Ward B. Jackman; Max S. Jacobson; Lieut. E. Gates-James, R.N.R.; Arthur Masson Kilby, M.A.; F. R. A. N. Knollys; Walter Russell Lambuth, M.A., D.D.; Jerome Landfield; Arthur Hyde Lay; T. H. Lawrence; George Gerard Longden; S. M. Lowenstein; Captain Edward Maitland Maitland (Essex Regiment); Major-General Sir Hugh McCalmont, K.C.B., C.V.O.; William James Thomas Mardon; Captain C. M. Marris; J. Graham de G. Martyr; Pe Maung; Major James Austin Meldon (Royal Dublin Fusiliers); Sid. Mitter (Rai Bahadur); Maung Mya-û; Francis Edward Norris; John Berwick Orgill; Rev. Harry Owen; Leonard Edgar Palmer; Lieut.-Colonel G. W. S. Patterson (Garrison Artillery); Laurence Richard Phillips; Somerset Playne; John Horton Pope, C.E.; John Richard Preece, C.M.G.; Colonel M. H. Purcell; Earl of Ranfurley, G.C.M.G.; Lieut.-Colonel Crompton Roberts; Fred Russell Roberts; Colonel William Howland Roberts, M.D.; Sir John Rodger, K.C.M.G. (Governor Gold Coast); Lionel Henry W. Sampson; Lieut. H. S. L. Scott (4th Hussars); San Shive; Fred. D. Snyder, M.D.; Barnard Sotham, C.E.; Graham Proctor Spicer; Gerhard A. Stockfeld; Mervyn Lawrence Tew; Peter Haig Thomas; Lieut. D. Hay Thorburn (Scottish Rifles); Rev. Edgar Vigers; Alfred R. Wagg; William Watkins; Harold Watson; Captain R. H. Watson (North Lancashire Regiment); Colonel George O. Welch, C.B.; Charles Stuart Welles; Richard Williams; Montagu Bouchier Wilson; Richard Winch; Robert Lloyd Woollcombe, M.A., LL.D.; Rev. Godfrey R. Wreford.*

The paper read was :—

"Mesopotamia: Past, Present, and Future." By Sir William Willcocks, K.C.M.G.

RESEARCH DEPARTMENT.

November 18, 1909.—Dr. A. STRAHAN in the Chair.

"Methods of Observation for Positions in the Polar Regions." By Arthur R. Hinks.

Third Meeting, November 22, 1909.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*Frank Bodenham; Captain Arthur Dickson* (*1st S. Lancashire Regt.*); *Arthur Hudson; Joseph Boyd Love, J.P.; James Douglas Moffat; George Early Pitt; Edward Herbert Simpson* (*The King's Regt.*); *Henry John Swinburne.*

THE INTERNATIONAL MAP CONFERENCE.

The PRESIDENT said: We are honoured here to-night by the presence of nearly all the members of the Conference which has been sitting during the whole of last week at the Foreign Office, discussing the best arrangements for making a map of the world on the scale of 1 : 1,000,000. The idea of creating such a map was, I believe, first originated by Professor Penck, who now occupies the chair of Geography at the Berlin University. He originated the idea at the Berne Conference, and at that Conference a committee was appointed. At each succeeding Conference that committee sent in an ad-interim report. At the last Congress which was held, that of Geneva, it was decided that the time had arrived when more vigorous steps might be taken. Certain regulations were then drawn out for the creation of such a map, and the conclusions arrived at by the Congress were sent to all the principal governments of the world, in the hope that this might provoke some definite action. As a result, the British Government issued a certain number of invitations to attend a Congress in England, and I am glad to say that a large number of governments accepted the invitation. During the last week representatives of the United States, Austria-Hungary, France, Germany, Italy, Russia, Spain, and also of Canada and Australia, have been devoting their whole energies to this subject. The result is exceedingly satisfactory, for they have arrived at unanimous conclusions, and the document was signed this afternoon at the Foreign Office by every single one of the delegates. A report will be sent to all the governments of the world, and I cannot help thinking that this is the first step towards the actual creation of a map on a scale of 1 : 1,000,000 of the whole world on a uniform plan, and that this is the most important result which has ever been obtained from our International Congresses of Geography. I am quite sure that you will wish me, in the name of the Royal Geographical Society, to express our hearty congratulations to the Congress on the happy conclusions of these labours, and, if I may for once speak in the name of the science of geography, to thank these delegates for having come so far and for labouring so earnestly to produce such an excellent result.

The paper read was:—

"A Naturalist's Travels on the Congo-Zambezi Watershed." By S. A. Neave.

Fourth Meeting, December 6, 1909.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*Hugh W. Coates; W. Hennessy Cook; Elphinstone Dayrell; Cyril H. James; Rudolph Said-Ruete; William Lutley Sclater, M.A.; David Simson; Joseph Mark Travers.*

The paper read was:—

"Explorations in the Hispar Region, Himalayas." By Dr. Hunter Workman and Mrs. Bullock Workman.

Fifth Meeting, December 13, 1909.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*William Henry Brooks; Williamson Buckman; Charles P. Conigrave; John Gilbert Dale; Francis Deverell; Dr. Harold St. Clair Elliott; Major Douglas Evans Forman (Royal Field Artillery); A. S. Gladstone; Hon. Sir Duncan E. Hay, Bart; Aubrey Herbert; Alfred Hoare; The Right Hon. Henry Hobhouse; Hy. Richard Powell; J. G. Raggi; C. W. St. John Rowlandson; J. Obed Smith; Albert James Thompson; T. M. Williams.*

The paper read was:—

"Exploring Journeys in Turkey in Asia." By Captain Bertram Dickson.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Académie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Isvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo, quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Hydrology. *M. k.k. G. Ges. Wien* 52 (1909): 223–240. **Hoffer.**
Unterirdisch entwässerte Gebiete in den nördlichen Kalkalpen (II. Teil). Von Prof. Dr. Max Hoffer.

Austria—Bosnia and Servia. **Cvijić.**
L'annexion de la Bosnie et la question Serbe. Par Jovan Cvijić. Paris, 1909. Size 9 × 5½, pp. x. and 70. *Map. Presented by the Author.*

Austria—Istria. *M. k.k. G. Ges. Wien* 52 (1909): 241–262. **Perko.**
Die Tropfstein- und Wasserhöhle "Dimnice" (Rauchgrotte) bei Markovsina in Istrien (Österreich). Von G. And. Perko. *Sketch-map and Sections.*

Austria—Tyrol. *M. k.k. G. Ges. Wien* 52 (1909): 263–267. **Götzinger.**
Die Lunzer Seen. Von Dr. Gustav Götzinger.

Belgium—Geography. **Mees.**
Le Mouvement Scientifique en Belgique 1830–1905. Les Sciences Géographiques.

Par J. Mees. Bruxelles, 1907. Size 12 × 8½, pp. 48. *Portraits, Sketch-maps, and Illustrations. Presented by the Author.*

Denmark—Bornholm. **Braun.**

Ueber die Morphologie von Bornholm. Von Dr. Gustav Braun. (Sonderabdruck aus dem xi. Jahresbericht der Geographischen Gesellschaft zu Greifswald 1908-09). Greifswald, 1909. Size 9 × 6, pp. 163–200. *Maps, Illustrations, and Sections. Presented by the Author.*

Denmark—Geodesy. **Madsen and Sand.**

Den Danske Gradmaaling; Ny Række, Hefte Nr. 5. 6 Breddebestemmelser udførte i Aarene 1890–1892 efter Horrebows Metode, tilligemed Resultaterne af Gradmaalingens senere Breddebestemmelser. Udgivet af Generalmajor V. H. O. Madsen; endelig redigeret af Oberstløjt. M. J. Sand. Copenhagen, 1909. Size 11 × 9, pp. 120. *Map.*

Denmark—Geodesy. **Zacharias.**

Den Danske Gradmaaling; Ny Række, Hefte Nr. 4. Nivellement over bredere Vandarealer. Udgivet af den danske Gradmaaling efter afdøds General Zachariaes Manuskript. Copenhagen, 1909. Size 11 × 9, pp. 118. *Sketch-maps and Diagrams.*

Report of levelling across the Great and Little Belts, The Sound, etc.

Europe—Oil-fields. **Dalton.**

A Sketch of the Geology of the Baku and European Oil-fields. By Leonard V. Dalton. (Reprinted from *Economic Geology*, vol. 4, No. 2, March, 1909). London, 1909. Size 10 × 7, pp. 89–117. *Sketch-maps and Sections. Presented by the Author.*

Faroe Islands. *Deutsche G. Blätter* **32** (1909): 40–57. **Erkes.**

Reisebilder von den Färöern. Von Heinrich Erkes.

France—Cartography. **Fordham.**

The Cartography of the Province of France, 1570–1757. By Sir Herbert George Fordham. (From the Cambridge Antiquarian Society's *Communications*, vol. 13.) [Cambridge], 1909. Size 11½ × 9, pp. 82–119. *Sketch-map. Presented by the Author.*

Noticed in the October number, p. 452. The names of two of the cartographers referred to should read "Bouguereau," "Le Clerc," and not as in the notice.

France—Finistère—Sea-water. **Legendre.**

B.I. Océanog. Monaco, No. 144 (1909): pp. 30.

Recherches physico-chimiques sur l'eau de la côte, à Concarneau. Par R. Legendre. *Diagrams.*

France—Hautes Alpes. *La G., B.S.G. Paris* **19** (1909): 15–44, 97–110. **Blanchard.**

L'habitation en Queyras. Par Raoul Blanchard. *Illustrations.*

A study of the form and distribution (according to altitude, etc.) of the inhabited places.

France—Movement of Population. *B.S.G. Marseille* **32** (1908): 297–302. **Barré.**

La répartition des originaires des Bouches-du-Rhône dans les autres départements. Par Henri Barré.

France—Provence. *La G., B.S.G. Paris* **19** (1909): 441–443. **Lemoine.**

Les tremblements de terre de Provence. Par Paul Lemoine. *Sketch-map.*

France—Provence. *C.R.A. Sc. Paris* **148** (1909): 1696–1698. **Lemoine.**

Sur les relations tectoniques du tremblement de terre de Provence. Par Paul Lemoine. *Sketch-map.*

France—Rhone. *B.S.G. Lyon.* 2 Ser. **2** (1909): 1–16. **Frécon.**

La Navigation du Rhône et le projet de canal latéral. Par Pierre Frécon.

Germany—Baden. *Forschungen deuts. Landes- u. Volksk.* **18** (1909): 193–360. **Pfeiffer.**

Die Zusammensetzung der Bevölkerung des Grossherzogtums Baden nach der Geburtigkeit auf Grund der Volkszählung vom 1. Dezember 1900. Von Dr. Hans Pfeiffer. *Maps.*

Hungary—Lake Balaton. **Cholnoky.**

Das Eis des Balatonsees. Von Dr. Eugen von Cholnoky. (Separatabdruck aus dem Werke 'Resultate der wissenschaftlichen Erforschung des Balatonsees.' I.

Band, 5. Teil. iv. Section.) Budapest, 1909. Size 11½ × 8, pp. 114. *Illustrations and Diagrams. Presented by the Author.*

See review in the September number, p. 328.

Italy—Hydrology. **R. Magistrato alle Acque.**

R. Magistrato alle Acque; Ufficio Idrografico, Pubblicazione N. 1. Prima Relazione annuale del Direttone dell' Ufficio Idrografico. Venice, 1909. Size 10 × 7, pp. 32.

Referred to *ante*, p. 78.

Italy—Hydrology. **R. Magistrato alle Acque.**

R. Magistrato alle Acque: Ufficio Idrografico, Pubblicazione N. 2. Stazioni d'osservazione; opere idrauliche di 1ª e 2ª categoria. Magazzini idraulici. Venice, 1909. Size 10 × 7, pp. 176. *Sketch-maps.*

Lists of the rain, river, and tide observing stations, chiefly in Venetia, under the newly organized Hydrographical Office.

Italy—Liguria. *Ann. Museo Civ. Storia Nat. Genova* **3** (1907–08): 419–469. **Béguinot.**

La vegetazione delle isole liguri di Gallinaria, Bergeggi, Palmaria, Tino e Tinetto.—Studio floristico e biogeografico. Par Dr. Augusto Béguinot.

Italy—Relief. *B.S. Belge Géol.* **23** (1909): Proc.-Verb., 14–24. **Van de Wiele.**

L'évolution tectonique de la péninsule italienne depuis le Pliocène et ses rapports avec le sisme du détroit de Messine. Par C. van de Wiele.

Italy—Sicily. *Norske G.S. Aarbog* **19** (1907–08): 25–52. **Reusch.**

Sicilien: en geografiske skisse. Af Dr. Hans Reusch. *Sketch-maps and Illustrations.*

Italy—Sicily -Earthquake. *B. American G.S.* **41** (1909): 409–422. **Hobbs.**

The Messina Earthquake. By Prof. W. H. Hobbs. *Sketch-maps and Illustrations.*

Norway—Geology. **Øyen.**

Skrifter Videnskabs-S. Kristiania, Math.- Naturvid. Kl. 1908 (1909): No. 2, pp. 126.

Kvartær-studier i den sydøstlige del af vort land. Af P. A. Oyen.

Studies of Quarternary formations in South-Eastern Norway, and their fossils.

Norway—Southern. *Norske G.S. Aarbog* **19** (1907–8): 53–62. **Reusch.**

Geologiske og geografiske bemerkninger om det landskap man ser ut over fra Holmenkollen ved Kristiania. Af Dr. Hans Reusch. *Illustration and Sections.*

Rumania.

Ministère de l'Agriculture, de l'Industrie, du Commerce et des Domaines. La Roumanie, 1866–1906. Bucarest, 1907. Size 9½ × 6½, pp. viii. and 494. *Maps and Illustrations.*

Russia—Archangel. *Questions Diplomatiques* **28** (1909): 68–84. **Labbé.**

La province d'Arkhangelsk. Par Paul Labbé. *Sketch-map.*

Spain—Balearic Islands. *B.S.G. Com. Paris* **31** (1909): 521–541. **Gallois.**

L'archipel des Baléares. Par Eugène Gallois. *Sketch-map.*

Spain—Léon. *B.R.S.G. Madrid* **50** (1909): 41–80. **Ciria y Vinent.**

Excursiones en la provincia de Léon. El pais de los maragatos: las montañas del Teleno: las antiguas minas romanas. Conferencia leida el 9 de Diciembre de 1908. Por D. Joaquin de Ciria y Vinent. *Illustrations.*

Strait of Gibraltar. *C.R.A. Sc. Paris* **148** (1909): 1227–1230. **Gentil.**

Sur la formation du détroit de Gibraltar. Par Louis Gentil.

Sweden—Climatology. **Andersson.**

The Climate of Sweden in Late Quaternary Period. Facts and theories. By Gunnar Andersson. (Reprinted from *Sveriges Geologiska Undersöknings Årsbok*, 1909.) Stockholm, 1909. Size 9½ × 6½, pp. 88. *Sketch-maps, Illustrations, and Sections.*

See November number, p. 569.

Sweden—Seismology. **Svedmark.**

Sveriges Geol. Undersökning, Årsbok **2** (1908): No. 3, pp. 124 (Ser. C, No. 211).

Jordskalf i Sverige, 1904–1906. Af Eugene Svedmark. *Maps.*

United Kingdom. **Davies.**

A geography of the British Isles, with numerous practical exercises. By Dr. A. Morley Davies. London: Macmillan & Co., 1909. Size 7½ × 5, pp. xiv. and 358. *Sketch-maps, Illustrations, and Diagrams. Price* 3*s*. *Presented by the Publishers.*

See notice at p. 75, *ante*.

United Kingdom—Bedfordshire, etc. **Woodward and Thompson.**

Memoirs of the Geological Survey. England and Wales. The water-supply of Bedfordshire and Northamptonshire from underground sources, with records of sinkings and borings. By Horace B. Woodward and Beeby Thompson, with contributions on rainfall by Dr. Hugh Robert Mill. London: Wyman & Sons, 1909. Size 9½ × 6, pp. vi. and 230. *Sketch-maps. Price* 4*s*. 6*d*.

The rainfall section was referred to in vol. **34**, p. 451.

United Kingdom—Bibliography. **Sheppard.**

Bibliography: Papers and Records published with respect to the Geology and Palæontology of the North of England, 1902–1908. Compiled and edited by Thomas Sheppard. (Reprinted from the *Transactions of the Yorkshire Naturalists' Union*, part 34.) Hull: A. Brown & Sons, 1909. Size 9 × 6, pp. 120. *Presented by the Author.*

United Kingdom—Communications. *G. Teacher* **5** (1909): 96–105. **Fairgrieve.**

The Roads to the North. By J. Fairgrieve. *Sketch-map.*

Traces the influence of surface features in the history of communications between London and the north.

United Kingdom—Cornwall. *Globus* **94** (1908): 329–333, 347–350. **Spethmann.**

Grundzüge der Oberflächengestaltung Cornwalls. Von Hans Spethmann. *Diagram and Illustrations.*

United Kingdom—Cornwall. *Archæologia* **61** (1908): 1–60. **Gray.**

On the Stone Circles of East Cornwall. By H. St. George Gray. *Illustrations, Sections, and Plans.*

United Kingdom—Croydon. **Latham.**

A Chapter in the History of Croydon. By Baldwin Latham. London: West, Newman, & Co., 1909. Size 8½ × 5½, pp. 104. *Presented by the Author.*

Deals historically with the health of Croydon.

United Kingdom—Deneholes. *J.R. Anthropological I.* **39** (1909): 44–76. **Hayes.**

Deneholes and other Chalk Excavations: their Origin and Uses. By the Rev. J. W. Hayes. *Illustrations.*

See Monthly Record, *ante*, p. 76.

United Kingdom—Devon and Cornwall. **Spethmann.**

Die Küste der Englischen Riviera. Von Hans Spethmann. Meereskunde: Sammlung Volkstümlicher Vorträge zum Verständnis der Nationalen Bedeutung von Meer und Seewesen. (Band 3, Heft 5.) Berlin, 1909. Size 8½ × 6, pp. 36. *Sketch-map and Illustrations. Presented by the Author.*

Instructive studies in physical geography on the coasts of Devon and Cornwall.

United Kingdom—Geological Survey.

Memoirs of the Geological Survey. Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for 1908. London, 1909. Size 9½ × 6, pp. 98. *Price* 1*s*.

United Kingdom—Hertfordshire. **Lydekker.**

Cambridge County Geographies (edited by F. H. H. Guillemard). Hertfordshire. By R. Lydekker. Cambridge: University Press, 1909. Size 7½ × 5, pp. x. and 174. *Maps, Illustrations, and Diagrams. Price* 1*s*. 6*d*. *Presented by the Publishers.*

United Kingdom—Ireland. **Westropp.**

The Forests of the Counties of the Lower Shannon Valley. By Thomas Johnson Westropp. (From the *Proceedings of the Royal Irish Academy*, vol. **27**, Section C, No. 13.) Dublin, 1909. Size 11 × 7½, pp. 270–300. *Sketch-maps.*

United Kingdom—Ireland—Archæology. **Kane.**

P.R. Irish A. **27** (1909): Sect. C, 301–328.

The Black Pig's dyke: the ancient boundary fortification of Uladh. By W. F. de Visnes Kane. *Sketch-map, Plan, and Sections.*

United Kingdom—Isle of Man. **Lamplugh.**

Memoirs of the Geological Survey: United Kingdom. The Geology of the Isle of Man. By G. W. Lamplugh. London, 1903. Size 10 × 6, pp. xiv. and 620. *Maps, Illustrations, and Sections. Presented by the Geological Survey.*

United Kingdom—Lancashire. **Weiss and Murray.**

Mem. and P. Manchester Lit. and Phil. S. **53** (1909): No. 14, pp. 8.

On the occurrence and distribution of some alien aquatic plants in the Reddish Canal. By Dr. F. E. Weiss and H. Murray.

United Kingdom—Map. *Globus* **96** (1909): 1-2. **Reinhard.**

Eine Manuskriptkarte der Britischen Inseln aus dem 16. Jahrhundert. Von Walter Reinhard. *Map.*

This was referred to in the October number (vol. **34**, p. 421).

United Kingdom—Mersey. **Nares.**

Report on the present state of the Navigation of the River Mersey (1908), to the Right Honourable the Commissioners for the Conservancy of the River Mersey. By Vice-Admiral Sir G. S. Nares. London: Darlington & Son, 1909. Size 9½ × 6, pp. 16. *Presented by the Acting Conservator.*

United Kingdom—Meteorology.

Godlee Observatory. Fourth Annual Report, 1908. Manchester, [1909]. Size 10 × 7, pp. 28. *Illustrations and Diagrams. Presented by the Principal.*

United Kingdom—Northumberland. **Knowles.**

J.R.I. Brit. Architects **16** (1909): 509–524.

Excavations at Corstopitum, Northumberland. By W. H. Knowles. *Plans, Sections, and Illustrations.*

This Roman settlement became important in the second century A.D.

United Kingdom—Rainfall. *G. Teacher* **5** (1909): 66-77. **Mill.**

Rainfall of the British Isles. By Dr. H R. Mill.

United Kingdom—Scotland—Loch Earn. **Chrystal.**

T.R.S. Edinburgh **46** (1908–09): 455–518.

An Investigation of the Seiches of Loch Earn by the Scottish Lake Survey. Part III. Observations to determine the Periods and Nodes. Part IV. Effect of Meteorological Conditions upon the Denivellation of Lakes. Part V. Mathematical Appendix on the Effect of Pressure Disturbances upon the Seiches in a Symmetric Parabolic Lake. By Prof. Chrystal. *Diagrams.*

United Kingdom—Scotland—Lochs. **Eisenmenger.**

C.R.A. Sc. Paris **148** (1909): 1796–1797.

Sur l'origine glaciaire du Loch Lomond et du Loch Tay, en Écosse. Par Gabriel Eisenmenger.

United Kingdom—Severn. **Ellis.**

The Lower Severn Valley, River and Estuary from the Warwickshire Avon to the Bristol Avon. By T. S. Ellis. (From *Proc. Cotteswold Naturalists' F.C*, vol. **16**, part 3, 1909.) Gloucester, 1909. Size 9½ × 6, pp. 241–263. *Sketch-maps and Diagrams. Presented by the Author.*

United Kingdom—Trent. **McAldowie.**

The Life History of the River Trent. By A. M. McAldowie. (Reprinted from *Transactions of the North Staffordshire Field Club*, vol. **43**, 1909.) N.P., 1909. Size 8½ × 5½, pp. 11. *Sketch-map and Section.*

United Kingdom—Windermere. **Weiss.**

Mem. and P. Manchester Lit. and Phil. S. **53** (1909): No. 11, pp. 10.

A preliminary account of the submerged vegetation of Lake Windermere as affecting the feeding-ground of fish. By Prof. F. E. Weiss.

Some of the bays are becoming choked with vegetation, including the rampant and troublesome Canadian pondweed.

ASIA.

Asiatic Languages.

A system for the transliteration of Persian, Afghan, and Arabian words. Compiled under the direction of the Foreign Department in India and of the Division of the Chief of the Staff, Intelligence Branch. Calcutta, 1909. Size 9½ × 6, pp. 72. *Presented by the Chief of the Staff, Indian Army.*

Central Asia—Tian-shan. *M. k.k. G. Ges. Wien* **52** (1909): 10-75. **Prinz.**

Die Vergletscherung des nördlichen Teiles des zentralen Tian-schan-Gebirges. Von Dr. Gyula Prinz. *Sketch-maps, Sections, and Illustrations.*

Ceylon—Survey. **Templeton.**

Survey Department, Ceylon. Report of Mr. R. S. Templeton, acting Surveyor-General. (Administration Reports, (1908, part i.) Size 13 × 8½, pp. 16. *Plan, Maps, and Illustrations. Presented by the Surveyor-General.*

China—Archæology. **Carus and Holm.**

The Nestorian Monument. An ancient record of Christianity in China. With special reference to the expedition of Frits V. Holm Edited by Dr. Paul Carus. Chicago, 1909. Size 9 × 6, pp. 42. *Illustrations. Presented by Mr. Frits V. Holm.*

Mr. Holm recently carried out the difficult task of obtaining a replica of this monument.

Chinese Empire—Manchuria. *J. Tokyo G.S.* **21** (1909). 309–319. **Torii.**

A travel to the Sira-muren and the Khingan mountains, China. By R. Torii. *Sketch-map.* [In Japanese.]

Chinese Turkestan. *B.S.R. Belge G.* **33** (1909): 97 108. **Bourgeois.**

Notes sur l'Orographie, les Villes, la Population, et l'Administration du Turkestan Oriental. Par H. Bourgeois.

French Indo-China—Cambodia. *B.S.G Comm. Paris* **31** (1909): 542 554. **Truffot.**

Note sur les irrigations et la mise en valeur de la vallée du Mékong au Cambodge. Par Truffot.

India—Himalaya. **Cora.**

Guido Cora. La spedizione del Duca degli Abruzzi ai Monti Karakorum. (Dalla "Nuova Antologia," 1° Aprile 1909.) Rome, 1909. Size 9½ × 6½, pp. 8.

India—Kashmir. *Records Geol. Surv. India* **37** (1909): 286–327. **Middlemiss.**

Gondwanas and Related Marine Sedimentary Systems of Kashmir. By C. S. Middlemiss. *Diagrams.*

India—Survey. ——

General Report on the Operations of the Survey of India . . . during 1907–08. Prepared under the direction of Colonel F B. Longe. Calcutta, 1909. Size 14 × 8½, pp. iv. and 62. *Maps and Illustration.*

Indian Ocean—Seychelles. **Fauvel.**

Unpublished documents on the history of the Seychelles Islands anterior to 1810, together with a cartography . . . and a bibliography of books and MSS. concerning these islands. Compiled by A. A. Fauvel, and published by order of the Governor of Seychelles (pp. xxxii., 418, and 6). List of maps and plans (pp. 28). Mahé (Seychelles), 1909. Size 9½ × 6½. *Maps in separate Portfolio* (size 26 × 17). *Presented on behalf of the Government of Seychelles by the Colonial Office.*

Japan—Bonin Islands. **Hattori.**

J. College Sc. Imp. Univ. Tokyo **23** (Art. 10) (1908): pp. 64.

Pflanzengeographische Studien über die Bonin-Inseln. Von H. Hattori. *Map and Illustrations.*

Japan—Formosa—Cartography. **Teleki.**

Connaissance et Représentation Cartographique de Formose jusqu'à la fin du XVII^eme^. Siècle. Par M. le comte Paul Teleki. (Revue de Hongrie, tome III. No. 5, 1909.) Budapest, 1909. Size 9½ × 6½, pp. 566–581.

A chapter from the author's large work on the Cartography of Japan.

Japan—Formosa—Mount Morrison. **Arnold.**

J. North China Br. R. Asiatic S. **40** (1909): 44–68.

The ascent of Mount Morrison (Niitaka Yama). By Julean H. Arnold. *Maps and Illustrations.*

The ascent was made in 1907 (see note in Monthly Record, December, p. 679).

Japan—Kyūshū—Mount Aso. *J. Tokyo G.S.* **21** (1909): 353–356. **Iwasaki.**

Recent State of the Eruption of Aso Volcano. By J. Iwasaki. *Diagrams* [In Japanese.]

Japan—Kyūshū—Mount Aso. **Nakamura and Hiratsuka.**

J. Tokyo G.S. **21** (1909): 180–186.

Some altitude Measurements in Aso Volcano. By Seiji Nakamura and Chunosuke Hiratsuka. [In Japanese.]

Japan—Nippara Caves. *J. Tokyo G.S.* **21** (1909) : 429–434. **Wakimizu.**
Limestone Caves of Nippara in Musashi. By T. Wakimizu. [In Japanese.]

Japan—Subsidence. *J. Tokyo G.S.* **21** (1909): 356–360. **Sasamoto.**
Depression of the land along the line of Railway Hyūga. By J. Sasamoto. *Illustration.* [In Japanese.]

Philippine Islands. *Philippine J. Sc.* **4** (1909): 1–18. **Ferguson.**
Physiography of the Philippine islands. III. Western Masbate. By Henry G. Ferguson. *Maps.*

Philippine Islands. *Philippine J. Sc.* **4** (1909): 19–26. **Smith.**
Contributions to the physiography of the Philippine Islands. IV. The Country between Subig and Mount Pinatubo. By Warren D. Smith. *Sketch-map and Illustrations.*

Philippines—Sulu Archipelago. **Saleeby.**
Philippine Bur. Sc., Div. Ethnol. Pub. **4** (1908): 117–391.
The History of Sulu. By Najeeb M. Saleeby. *Sketch-maps and Diagrams.*
Opens with a geographical description of the archipelago.

Russia—Altai. *Annuaire géol. et min. Russie* **12** (1910): 1–7. **Pilipenko.**
Zur Frage über die Glacial-Periode im Altai. Von P. P. Pilipenko. *Illustrations and Section.* [In Russian; *résumé* in German.]

Russia—Aral. *Petermanns M.* **55** (1909): 82–86. **Vocikof.**
Der Aralsee und sein Gebiet nach den neuesten Forschungen. Von Prof. Dr. A. Wocikow. *Maps.*

Russia—Siberia—Khatanga. **Tolmatschof.**
Travaux Sous-Sect Troitzkossawski-Kiakhta, Imp.-Russ. G.S. **9** (1906): No. 1, 6–27.
Expédition de Khatanga de la Société Russe de geographie. Par I P. Tolmatschow. [In Russian]

Turkey—Adana. ——
Turkey. Report for the year 1908 on the trade of the province of Adana. (Diplomatic and Consular Reports Annual series, No. 4235, 1909). Size 9½ × 6, pp. 26. *Price* 2*d.*

Turkey—Kurdistan. *J. R. Anthropological I.* **38** (1908): 451–486. **Sykes.**
The Kurdish Tribes of the Ottoman Empire. By Mark Sykes *Sketch-map.*

Turkey—Railway. *Globus* **95** (1909). 201–206. **Janke.**
Die Bagdadbahn und der Gülek Boghas (Cilicische Tore) im Taurus. Von A. Janke. *Illustrations.*

AFRICA.

Belgian Congo—Zoology. **Schouteden.**
Annales du Musée du Congo. Zoologie—Serie III. Catalogues raisonnés de la Faune Entomologique du Congo Belge. Hémiptères, fam. Pentatomidæ, par H. Schouteden. Tome I. Fascicule I Brussels, 1909. Size 14½ × 11, pp. 1–86. *Illustrations.*

French Congo. *B.S.G. Marseille* **32** (1909): 303–343. **Baudon.**
De Brazzaville à Franceville: Les savanes du Congo français. Par M. A. Baudon.

French Congo. *B.S.G. Marseille* **32** (1909): 344–355. **Roche.**
Au pays des Pahouins: Du Gabon au Cameroun. Conference de M. le commandant Roche.

French Sudan. *C.R.A. Sc. Paris* **148** (1909): 1698–1700. **Gardo.**
Aperçu géologique sur les régions situées à l'est et au nord-est du Tchad. Par G. Gardo. *Sketch-map.*

French West Africa—Senegal. *B.S.G. Comm Bordeaux* **32** (1909): 49–55. **Fromaget.**
L'hydrographie du fleuve Sénegal. Par Capitaine Fromaget.

German South-West Africa. *Z. Kolonialpolitik* **10** (1908): 857–864. **Fitzner.**
Die Regenverhältnisse Deutsch-Südwestafrikas. Von Prof. Dr. Rud. Fitzner.

German South-West Africa—Diamonds. **Merensky.**
T. Geol. S. South Africa **12** (1909): 13–23.
The diamond deposits of Luderitzland, German South-West Africa. By Hans Merensky. *Sketch-map and Illustrations.*

German South-West Africa—Ethnology. **Geibel.**
Deutsches Kolonialblatt **20** (1909): 824–833.
Die Eingeborenen der deutschen Kalahari. Von Leutnant Geibel.

German South-West Africa. **[Dinter.]**
Deutsches Kolonialblatt **20** (1909): 783–787.
Eine botanische Forschungsreise nach dem Norden.

Gold Coast. ———
Northern territories of the Gold Coast. Report for 1908. (Colonial Reports, Annual, No. 602, 1909.) Size 9½ × 6, pp. 18. *Price* 1½*d.*

Gold Coast—Disease. **Simpson.**
Report on plague in the Gold Coast in 1908. By Dr. W. J. Simpson. London: J. & A. Churchill, 1909. Size 13 × 8½, pp. 56. *Illustrations and Diagrams. Price* 2*s. net. Presented by the Publishers.*

Kamerun. *Deutsches Kolonialblatt* **20** (1909): 860–866. **Schorkopf.**
Die forstwissenschaftliche Expedition, 1908-09. (Bericht des Forstassessors Schorkopf.)
See note in vol. **34**, p. 682.

Kamerun. *Globus* **95** (1909): 133–138. **Diesing.**
Von Joko nach Ngaumdere. Eine Reise in Adamaua. Von Dr. Ernst Diesing.

Kamerun. *Deutsches Kolonialblatt* **19** (1908): 1148-1151. ———
Die Alkasom—Muntschi—Bascho-Expedition. *Sketch-map.*
The field of operations was north-east of the Cross river, near the Nigerian frontier.

Madagascar—Ethnology. *J. Asiatique* **11** (1908). 353–500. **Ferrand.**
L'origine africaine des Malgaches. Par Gabriel Ferrand.

Madagascar—Tritriva volcano. **Bourdariat and Johnston-Lavis.**
B.S. Belge Géol., Mém. **22** (1908): 103–116.
Note sur le remarquable volcan de Tritriva au centre de l'île de Madagascar avec des observations sur l'origine du quartz dans les basaltes et autres roches basiques. Par Alexandre Bourdariat et Dr. Johnston-Lavis. *Sketch-map, Diagrams, and Illustrations.*

Nigeria—Ethnology. **Parkinson.**
Yoruba Folk-Lore. By John Parkinson. (Reprinted from the *Journal of the African Society*, vol. 8, 1909.) London, 1909. Size 8½ × 6, pp. 165-186. *Presented by the Author.*

Nigeria—Northern. **Dunstan.**
Northern Nigeria. Report on the results of the Mineral Survey, 1906–07. By Prof. Wyndham R. Dunstan. (Colonial Reports, Miscellaneous, No. 59, 1909.) Size 9½ × 6, pp. 22. *Price* 1½*d.*

Nile—Historical. **Partsch.**
Des Aristotle's Buch 'Ueber das Steigen des Nil.' Eine Studie zur Geschichte der Erdkunde im Altertum. Von J. Partsch. (Des xvii. Bandes der Abhandlungen der Philosophisch-Historischen Klasse der Königl. Sächsischen Gesellschaft der Wissenschaften No. 16.) Leipzig: B. G. Teubner, 1909. Size 11 × 7½, pp. 551–600. *Diagram.*

Nile Basin—Meteorology. **Lyons.**
Egypt. Survey Department Paper, No. 9. The Rains of the Nile Basin and the Nile Flood of 1907. By Captain H. G. Lyons. Cairo, 1909. Size 10½ × 7½, pp. 60. *Sketch-map and Diagrams.*

Nyasaland. *J.R. Anthropological I.* **39** (1909): 35–43. **Stigand.**
Notes on the Tribes in the neighbourhood of Fort Manning, Nyassaland. By Captain C. H. Stigand.

Rhodesia. *Quart. J. Geol. S.* **65** (1909): 408–439. **Molyneux.**
On the Karroo System in Northern Rhodesia, and its Relation to the General Geology. By Arthur John Charles Molyneux. *Sketch-maps, Sections, and Illustrations.*

Rhodesia—Rainfall. *G. Teacher* **5** (1909): 77–81. **Tripp.**
Rainfall of Southern Rhodesia. By C. E. Tripp and F. E. B. Tripp.

Sahara—Geology. *C.R.A. Sc. Paris* **148** (1909): 1616–1619. **Garde.**
Résultats de l'exploration géologique et minéralogique de l'Eguéï. Par G. Garde.

Sahara—Observations. *La G., B.S.G. Paris* **19** (1909): 111–115. **Nièger.**
Observations astronomiques dans le Sahara algérien. Tidikelt et partie sud du territoire d'Aïn-Sefra (mars et avril 1907). Par J. Nieger.

Sahara—Sands. *B.S.G. Alger* **13** (1908): 141–180. **Cauvet.**
Les Sables du Sahara Algérien. Par Commdt. Cauvet. *Illustrations.*

South Africa—Geology. **Schwarz.**
The discoveries of economic importance made by the Albany pioneers. By E. H. L. Schwarz. (Presidential Address, Sections B and C; South African Association, Grahamstown, 1908.) Grahamstown, 1908. Size 9 × 6, pp. 16. *Portrait.*

Uganda. ———
Uganda-Report for 1907–08. (Colonial Reports, Annual, No. 600, 1909.) Size 9½ × 6, pp. 36. *Sketch-map. Price* 4½*d.*

Victoria Nyanza. **Craig.**
Earth-movements at Lake Victoria. By J. I. Craig. (Reprinted from the *Cairo Scientific Journal*, No. 31, vol. 3, April, 1909.) Alexandria, 1909. Size 10½ × 7 (1 page).

The writer contests Captain Lyons' conclusions (cf. *Journal*, vol. **33**, p. 328), but the latter has since (same *Journal*, July, p. 176) shown that his meaning had been in part misunderstood by Mr. Craig.

West Africa—Boundary. ———
Treaty Series, No. 17, 1909. Exchange of notes between the United Kingdom and Germany, confirming protocols defining Boundaries between British and German Territories in Africa. I. Gorege to Lake Chad (February 12, 1907). II. Uba to the Maio Tiel (March 11, 1907). London, 1909. Size 9½ × 6, pp. 6. *Map. Price* 6½*d.*

The protocols, originally signed by the British and German local representatives in 1907, refer to special sections of the boundary regarding which questions had arisen.

NORTH AMERICA.

Alaska. **Greely.**
Handbook of Alaska: its resources, products, and attractions. By Major-General A. W. Greely. London: T. Fisher Unwin, 1909. Size 8½ × 5½, pp. xiv. and 289. *Maps and Illustrations. Price* 8*s.* 6*d. net.*

Alaska. *National G. Mag.* **20** (1909): 585–593. **Greely.**
The Economic Evolution of Alaska. By Major-General A. W. Greely. *Illustrations.*

Alaska. *Appalachia* **12** (1909): 45–54. **Solomons.**
Surface Features of Northern Alaska. By Theodore S. Solomons.

Alaska—Mountains. *National G. Mag.* **20** (1909): 611–623. **Sargent.**
The Monarchs of Alaska. By R. H. Sargent. *Illustrations.*

Alaska and Canada—Boundary. *National G. Mag.* **20** (1909): 593–607. **Riggs.**
Marking the Alaskan Boundary. By Thomas Riggs. *Illustrations.*

Canada. ———
Annual Report of the Department of the Interior for the Fiscal year ending March 31, 1908. Ottawa, 1909. Size 9½ × 6½, pp. xl. and 414. *Illustrations.*

Includes, as usual, the report of the Surveyor-General, also issued separately in an enlarged form.

Canada. ———
Supplement to the Annual Report of the Department of Marine and Fisheries. Marine. Seventh Report of the Geographic Board of Canada, containing all decisions to June 30, 1908. Ottawa, 1909. Size 9½ × 6½, pp. 100.

Canada—Rocky Mountains. *Canadian Alpine J.* **2** (1909): 79–84. **Burwash.**
Structures in the vicinity of Rogers Pass. By E. M. Burwash. *Sketch-map and Sections.*

Canada—Selkirks. *Appalachia* **12** (1909): 16–30. **Palmer.**
A Pioneer Reconnaissance in the Northern Selkirks. By Howard Palmer. *Sketch-map and Illustrations.*

Canada—Surveys.

Department of the Interior. Annual Report of the Topographical Surveys Branch, 1907–08. Ottawa, 1909. Size 9½ × 6½, pp. vi., and 362. *Sketch-map and Illustrations. Maps in Separate Cover.*

United States—Magnetism. **Hazard.**

Department of Commerce and Labor. Coast and Geodetic Survey. Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory at Baldwin, Kansas, 1901–1904. By Daniel L Hazard. Washington, 1909. Size 11 × 9, pp. 138. *Illustrations.*

The Same, at Cheltenham, Maryland, 1901–1904. Washington, 1909. Pp. 206. *Sketch-map, Diagrams, and Illustrations.*

United States—Maine. **Clapp and Bayley.**

U.S Geol. Surv., Water-Supply Paper **223** (1909): pp. 268.

Underground waters of Southern Maine. By Frederick G. Clapp, with records of deep wells by W. S. Bayley *Sketch-maps, Diagrams, and Illustrations.*

United States—Maine. *U.S. Geol. Surv. B.* **376** (1909): pp. 128. **Bastin and Davis.**

Peat Deposits of Maine. By Edson S. Bastin and Charles A. Davis. *Sketch-maps and Illustrations.*

United States—Montana. *U.S. Geol. Surv. B.* **356** (1909): pp. 86. **Fisher.**

Geology of the Great Falls Coalfield, Montana. By Cassius A. Fisher. *Sketch-maps, Sections, and Illustrations.*

United States—Montana. **Fisher.**

U.S. Geol. Surv Water-Supply Paper **231** (1909): pp. 90.

Geology and Water Resources of the Great Falls Region, Montana By Cassius A. Fisher. *Maps and Illustrations.*

United States—Population. *J.R. Anthropological I.* **38** (1908): 221–240. **Ripley.**

The European population of the United States. By Prof. William Z. Ripley.

United States Wyoming. **Darton and Siebenthal.**

U.S. Geol. Surv. B. **364** (1909): pp. 82.

Geology and Mineral Resources of the Laramie Basin, Wyoming. A preliminary report by N. H. Darton and C. E. Siebenthal. *Maps, Sections, and Illustrations.*

CENTRAL AND SOUTHERN AMERICA.

Argentine—Andes. *Sitzb A.W. Wien* **116** (Abt. I.) (1907): 649–674. **Keidel.**

Ueber den Bau der argentinischen Anden. Von H. Keidel. *Sections.*

Argentine—Archæology. **Debenedetti.**

Excursión arqueológica á las ruinas de Kipón (Valle Calchaquí—Provincia de Salta). Por Salv. Debenedetti. Buenos Aires, 1908. Size 11 × 7½, pp. 56. *Plan and Illustrations. Presented by the Author.*

Bolivia. **Ballivián.**

Delegación Nacional del Territorio de Colonias del N.O., Bolivia, 1908. Informe del Delegado Nacional, Adolfo Ballivián (pp. vi, 238, and vi.). Anexos al Informe (pp. vi. and 138). [Para, 1909.] Size 9½ × 6½. *Maps. Presented by the Author.*

Brazil. **Lima.**

Le Brésil. Ses Limites actuelles; ses voies de pénétration. Rapports présentés au Congrès International de Géographie de Genève, Juillet-Août 1908. Par M. de Oliveira Lima. Antwerp, 1908. Size 8½ × 5½, pp. 14. *Maps. Presented by the Author.*

Brazil. *Deutsches Kolonialblatt* **20** (1909): 498–511, 541–557. **Sandmann.**

Eine Studienreise in das tropische Brasilien. Von D. Sandmann. *Illustrations.*

Chile.

Chile: a handbook. Compiled by the International Bureau of American Republics. Washington, D.C.: Bureau, [1909]. Size 9½ × 6, pp. 236. *Map and Illustrations. Presented by the Bureau.*

Chile—Treaties. **Pinilla.**

Ministerio de Relaciones Exteriores. Anexos á la Memoria presentada por el Ministro Dr. Claudio Pinilla (Tratados Vigentes), 1908. Santiago de Chile. 1908. Size 10½ × 7, pp. 876.

AUSTRALASIA AND PACIFIC ISLANDS.

New Caledonia—Climatology. **Mialaret and Fraysse.**

Contribution à l'étude du Climat de la Nouvelle-Calédonie. (La Pluie de 1903 à 1908.) Par Dr. H. Mialaret et A. Fraysse. Noumea, 1909. Size, 9½ × 6, pp. 16.

See note in the Monthly Record, *ante*, p. 82.

South Australia. **Bonnin.**

P.R.G.S. Australasia, South Austr. Br. **10** (1907–08): 67–89.

North-western District of South Australia, in September, 1862. By Josiah Bonnin.

South Australia—Geology. **Howchin.**

P.R.G.S. Australasia, South Austr. Br. **10** (1907–08): 204–219.

Geological Observations on some of the Localities visited by the "Governor Musgrave" Party in January, 1907. By Walter Howchin. *Illustrations.*

POLAR REGIONS.

Antarctic—German Expedition. **Drygalski.**

Deutsche Südpolar Expedition 1901–1903. . . . herausgegeben von Erich v. Drygalski. II. Band, Heft 1 (pp. 1 124); IV. Band, Heft 1 (pp. 1–124); and V. Band, Heft 2 (pp. 105–310). Berlin: G. Reimer, 1909. Size 14 × 10½. *Maps and Illustrations. Presented by the Imperial Foreign Office, Berlin.*

Antarctic—German Expedition. **Drygalski.**

Deutsche Südpolar-Expedition, 1901–1903. . . . herausgegeben von Erich von Drygalski. Vols. **9** and **10** (Zoologie, Bände I und II.) Berlin: G. Reimer, 1908–1909. Size 13½ × 10, pp. (vol. **9**) xii. and 568; (vol. **10**) viii. and 604. *Maps and Illustrations. Presented by the Imperial Foreign Office, Berlin.*

Arctic—Meteorology. *Symons's Met Mag.* **44** (1909): 139–141. ———

The Lowest Temperature on the Earth's Surface.

Refers to Dr. Cook's report of a temperature of - 83° F.

Arctic—Spitsbergen. *Norske G.S. Aarbog* **19** (1907–8): 134 151. **Isachsen.**

Spitsbergenekspeditionen 1907. Af Gunnar Isachsen. *Sketch-map.*

Greenland—Amdrup Expedition **Amdrup and others.**

Meddelelser om Grønland **28** (1904–09): pp. 542.

Carlsbergfondets Expedition til Ost-Gronland, udført i Aarene 1898–1900 under Ledelse af G. Amdrup. *Maps, Diagrams, Illustrations.*

Greenland—Eskimo. **Thalbitzer**

Ethnological description of the Amdrup collection from East Greenland, comprising objects found in Eskimo house-ruins and graves north of Angmagsalik between 68° and 75° lat. N. By W. Thalbitzer. (Reprinted from *Meddelelser om Grønland*, vol. **28**.) Copenhagen, 1909. Size 9 × 6, pp. 328–550. *Illustrations.*

Cf. note in the October number, p. 459.

Greenland—Oceanography. *La G., B.S.G. Paris* **19** (1909): 417 434 **Damas.**

L'océanographie de la mer du Grönland. Résumé des observations de l'expédition de la Belgica en 1905. Par D. Damas. *Charts and Illustrations.*

MATHEMATICAL GEOGRAPHY.

Cartography. *M. k.k. G. Ges. Wien* **52** (1909): 186–194. **Brückner.**

Zur Frage der Farbenplastik in der Kartographie. Von Eduard Brückner und Dr. Arthur Brückner. *Illustrations.*

Cf. note in vol. **29**, p. 680.

Mathematical Geography. *M. k.k. G. Ges. Wien* **52** (1909): 150–185. **Möller.**

Graphische Lösung von Aufgaben aus der astronomische Erdkunde. Von Dr. Max Möller. *Illustrations.*

Navigation—Great Circles. *Ann. Hydrographie* **36** (1909): 497–501. **Kobbe.**

Angenäherte Darstellung des Hauptbogens in der Merkatorkarte. Von Oberstleut. v. Kobbe. *Diagrams.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Cartography—Projection. *Scottish G. Mag.* **25** (1909): 449–469. **Cahill.**
An Account of a New Land Map of the World. By Bernard J. S. Cahill. *Sketch-maps and Diagrams.*

Describes a somewhat complicated system of projection, by which distortion of the land-mass can be reduced to a minimum.

Climatology. *Monthly Weather Rev.* **36** (1908): 359–364; 446–450. **Huntington.**
The climate of the historic past. By Ellsworth Huntington. *Diagram.*

Geomorphology—Mountain Ranges. **Sawicki.**
M. k.k. G. Ges. Wien **52** (1909): 136–149.
Der Nordappenin und die Westkarpathen, eine morphologische Parallele. Von Dr. Ludomir R. v. Sawicki. *Sections.*

Geophysics. *Geol. Mag.* v. **6** (1909): 145–148. **Schwarz.**
Secular Earth-Creep. By Prof. E. H. S. Schwarz. *Sketch-map.*

The writer suggests that the sun's attraction "must in course of geological periods cause the ridges in the Earth's crust to creep westwards," a continuous obliteration of features being the result.

Glacial Periods. *B.S. Belge Géol.* **23** (1909): 154–160. **Grégoire.**
Sur une cause possible de la glaciation du globe terrestre. Par Ach. Grégoire.

The suggested cause is the reversal of the normal difference of temperature between continental and subocean areas, caused by oscillations between sea and land.

Glacial Periods. *Deutsche G. Blätter* **32** (1909): 1–30. **Nölke.**
Die Entstehung der Eiszeiten. Von Dr. Fr. Nölke.

Glaciers. *Canadian Alpine J.* **2** (1909): 92–96. **Reid.**
Observations of Glaciers. By Harry Fielding Reid. *Illustrations.*

Hints on observing glaciers.

Glaciers. *Canadian Alpine J.* **2** (1909): 56–78. **Vaux.**
Modern Glaciers. By Wm. S. Vaux. *Illustrations.*

Meteorology—Evaporation. *Monthly Weather Rev.* **36** (1908): 437–445. **Bigelow.**
Studies on the phenomena of the evaporation of water over lakes and reservoirs. IV. The progress of the research in 1908, and the proposed campaign for the years 1909 and 1910. By Prof. Frank H. Bigelow.

See *ante*, p. 83.

Meteorology—Refraction. *Cairo Sc. J.* **3** (1909): 129–136. **Xydis and others.**
Terrestrial Refraction at Alexandria. By C. Xydis, with a note by J. I. Craig. Refraction across the Nile Valley. By B. F. E. Keeling. *Diagram.*

See *ante*, p. 79.

Rocks. **Fletcher.**
British Museum (Natural History). Mineral Department. An Introduction to the Study of Rocks, and Guide to the Museum Collection. By L. Fletcher. Fourth edition. London, 1909. Size 8½ × 5½, pp. viii. and 156. *Plan. Presented.*

Seismology. *J. Franklin I.* **167** (1909): 434–472. **Carter.**
Earthquakes in the Light of the New Seismology. By Prof. Oscar C. S. Carter. *Sketch-map, Illustration, and Diagrams.*

Seismology. *Quart. Review* **419** (1909): 477–500. **Davison.**
Earthquakes and their Causes. By Charles Davison. *Diagram.*

Seismology. *J. African S.* **8** (1909): 398–411. **Struck.**
African ideas on the subject of Earthquakes. By Bernhard Struck.

See vol. **34**, p. 457.

Subterranean Fire. *Sitzb. math.-phys. Kl. A.W. München*, 1908: 123–139. **Günther.**
Erdbrände und deren angebliche geophysische Konsequenzen. Von Siegmund Günther.

An examination of Werner's Theory of Vulcanicity, with a discussion of the pseudo-volcanic phenomena of burning mountains, etc.

Tides. **Harris.**
The Tides, their causes and representation. By Rollin Arthur Harris. (Reprinted

from the *Popular Science Monthly*, June, 1909.) New York, 1909. Size 10 × 7, pp. 521–539. *Charts and Diagrams.*

Tides. *Beiträge Geophysik* **10** (1909): 125–151. **Müller.**

Zur Theorie der Entstehung der Tiden. Von Aloys Müller. *Diagrams.*

GENERAL.

Bibliography. **Baschin.**

Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band xiv. 1905. Berlin: W. H. Kühl, 1909. Size 9½ × 6, pp. xvi. and 545. *Presented by the Gesellschaft für Erdkunde, Berlin.*

British Empire—Surveys.

The surveys of British Africa, Ceylon, the Federated Malay States, Jamaica, Trinidad, British Honduras, Fiji. The annual report of the Colonial Survey Committee. Fourth year: to March 31, 1909. (Colonial Reports, Annual No. 608, 1909.) Size 9½ × 6, pp. 52. *Index-map and Illustration. Price* 1*s.* 7*d.*

This was noticed in the December number, p. 618

Education. *J.G.* **7** (1909): 193–208. **Marbut.**

The College Unit in Physical Geography. By C. F. Marbut.

On the scope and methods of geography in Education (See October number, p. 460.)

Education—Map-reading. *G. Teacher* **5** (1909): 81–85. **Reynolds.**

Map Reading and Imagination. By Joan B. Reynolds.

Education—Models. *G. Teacher* **5** (1909): 19–23. **McMichael.**

A method of modelling in relief by means of serial sections from a contoured map By J. A. McMichael. *Illustrations.*

Education—Surveying. *G. Teacher* **5** (1909): 86–90. **Deas and Mort.**

Surveying in Schools. By J. Deas and F. Mort. *Sketch-map.*

Education—Text-book. **Wallis.**

Practical exercises in geography A two years' course. By B. C. Wallis. London: Macmillan & Co., 1909. Size 7½ × 5, pp. xxiv. and 184. *Sketch maps, Illustrations, and Diagrams. Price* 2*s.* 6*d. Presented by the Publishers.*

Mountaineering. *Appalachia* **12** (1909). 30–33 **Balch.**

High Mountain Ascents. By Edwin Swift Balch.

Notes on the highest ascents of recent years

Ski in Mountaineering. *Alpine J.* **24** (1909): 553–564. **Clarke.**

Mountaineering on Ski. By E. Russell Clarke. *Illustrations*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from November 1 to 30, 1909.

4 miles to 1 inch:—

Revised, in outline, engraved, 8 (20 and 24). 1*s.* 6*d. each.*
County diagrams, showing civil parishes, with a table of their area. Pembrokeshire. 6*d.*

1-inch—(third edition):—

Outline, 198, 231. 1*s. each* (engraved).
With hills in black or brown, 198, 231. 1*s. each* (engraved).
Large-sheet Series, printed in colours, folded in cover or flat in sheets, 50, 116, 124, 126. *On paper*, 1*s.* 6*d.*; *mounted on linen*, 2*s.*: *mounted in sections* 2*s.* 6*d. each.*

6-inch—County Maps :—

Hampshire, 7 sheets. **Kent**, 17 sheets. **Lancashire**, 1 sheet. **Yorkshire**, 17 sheets. *Price* 1*s. each.*

25-inch—County Maps :—

Cheshire, 22 sheets. **Hampshire**, 27 sheets. **Lancashire**, 8 sheets. **Sussex**, 32. sheets. **Yorkshire**, 90 sheets. 3*s. each.*

(*E. Stanford, London Agent.*)

England and Wales. **Geological Survey**

4 miles to 1 inch :—

New Series, colour printed. Solid edition (21 and 25). 2*s.* 6*d.*

1-inch map :—

New Series, colour printed. Drift edition, 347, 64. 1*s.* 6*d. each.*

(*E. Stanford, London Agent.*)

Finland.

Suomen Kruunummetsäin Kartta. [Forest map of Finland.] Scale : 1 : 800,000 or 1 inch to 12·6 stat. miles. 4 sheets. [Helsingfors], 1906.

A general map of Finland, showing forests by green tinting. Besides this special feature, a considerable amount of general information is given, and the map is clearly printed in colours.

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets : (Kupferdruck Ausgabe) 362, Ballenstedt ; 574, Heilbronn. Berlin : R. Eisenschmidt, 1909.

Spain. **Instituto Geografico y Estadistico, Madrid**

Mapa Topografica de España. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheet 1022, Campillos. Madrid : Instituto Geografico y Estadistico, 1909.

ASIA.

Borneo. **Topographical Bureau, Batavia.**

Overzichtskaart van het eiland Borneo. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. Batavia : Topographical Bureau, 1909.

A new edition of a general map of Borneo. Shows clearly the location of various minerals by coloured symbols, in addition to other useful information.

Celebes. **Topographical Bureau, Batavia.**

Overzichtskaart van het eiland Celebes. Scale 1 : 1, 250,000 or 1 inch to 19·7 stat. miles. Batavia : Topographical Bureau, 1909.

A useful map of the island of Celebes, compiled from the latest information, and well produced in colours. In addition to the general map there are two insets of the island, one showing political divisions and means of communication, and the other the density of population. There are also tables of the imports and exports

Indian Government Surveys. **Surveyor-General of India.**

India and adjacent countries : scale 1 : 1,000,000 : Persia 2 sheets, Bombay Presidency 1 sheet ; 1 inch to 1 mile : North-West Frontier Provinces 12 sheets, Bombay 9 sheets, Madras 1 sheet, Punjab 6 sheets, United Provinces 4 sheets, Central Provinces and Berar 8 sheets, Bengal 8 sheets, Eastern Bengal and Assam 1 sheet, Burma 2 sheets. India, 1 inch to 64 miles. Frontier Surveys : North-West Trans-Frontier, 1 inch to 4 miles, 1 sheet. Bengal : Provincial map, 1 inch to 32 miles ; Bengal Survey, 1 inch to 1 mile, 8 sheets. Bombay Survey, 1 inch to 1 mile, 1 sheet ; Levels in Sind, 1 inch to 2 miles, 1 sheet. Burma : Provincial map, 1 inch to 32 miles ; Burma Survey, 1 inch to 1 mile, 3 sheets. Central India and Rajputana : C. I. Agency, 1 inch to 16 miles ; Rajputana Agency, 1 inch to 16 miles ; Central India and Rajputana Survey, 1 inch to 1 mile, 5 sheets. Central Provinces, 1 inch to 32 miles ; Central Provinces Survey, 1 inch to 1 mile, 4 sheets. Eastern Bengal and Assam, 1 inch to 32 miles ; Eastern Bengal and Assam Survey, 1 inch to 1 mile, 4 sheets. Madras Presidency, 1 inch to 32 miles. Punjab Survey, 1 inch to 1 mile, 3 sheets ; Levels in the Punjab, 1 inch to 2 miles, 5 sheets. United Provinces : Farukhabad District, 1 inch to 4 miles ; United Provinces Survey, 1 inch to 1 mile, 17 sheets. Afghanistan, 1 inch to 32 miles. Baluchistan Agency with Sind, 1 inch to 32 miles. Eastern Turkestan, 1 inch to 32 miles. Calcutta : Surveyor-General's Office, 1909. *Presented by the Secretary of State for India, through the India Office.*

AFRICA.

Algeria. **Gouvernement Général de l'Algérie.**

Département de l'Alger. Carte des Voies de Communication dressée par ordre de M. C. Jonnart, Gouverneur-Général. Scale 1 : 400,000 or 1 inch to 5·5 stat. miles. Algiers : Gouvernement Général de l'Algérie, Service Cartographique, 1909. *Presented by M. R. de Flotte Roquevaire, Chef de Service Cartographique.*

One of a series of outline maps of Algeria, without hills, showing means of communication. Railways and roads, open, under construction, and projected, are clearly distinguished, whilst their character and relative importance are also indicated by the symbols employed.

AMERICA.

Argentina—Buenos Aires. **Dept. de Obras Publicas, Buenos Aires.**

Plano de la Ciudad de Buenos Aires, Capital de la Republica Argentina con el Trazado General de Calles. Confeccionado por el Departamento de Obras Publicas de la Municipalidad. Scale 1 : 10,000 or 6·3 inches to 1 stat. mile. Twelve sheets. Buenos Aires : Departamento de Obras Publicas de la Municipalidad, 1907. *Presented by H. Frank Previté, Esq.*

A large-scale plan of the city of Buenos Aires in twelve sheets, each measuring 28 inches by 22 inches, carefully constructed from the surveys and plans in the Department of Public Works of that city.

Colombia. **Vergara y Velasco.**

Atlas Complete de Geografia Colombiana por Francisco Javier Vergara y Velasco. Parts 1–5. Bogota : Imprenta Eléctrica, 1906.

This is the sixth part of an atlas of the Republic of Colombia, of which the publication was commenced in 1906. Each part contains about twelve maps, accompanied by text, dealing with the general and physical geography, geology, history, and population of the country; in addition to which are plans of towns, charts of the coast, and rivers, and numerous sections. There will be altogether eight parts, and it is intended to complete the atlas during the present year.

The cartographical material of Colombia is so scanty, and so few maps of the country exist, that any addition to our knowledge will be welcomed: but notwithstanding the fact that this atlas contains interesting information, the maps are so roughly drawn and lithographed, and are generally such crude productions, that much of the value they might have is lost. It is greatly to be regretted that instead of publishing facsimiles of the author's rough pen-and-ink drawings, it was not found possible to place the work in the hands of experienced geographical draughtsmen.

United States. **Philip.**

Philips' Comparative Series of Large School Maps. United States. Scale 1 : 3,000,000 or 1 inch to 47·3 stat. miles. London : George Philip & Son, Ltd., 1909. *Price 14s. mounted on rollers and varnished. Presented by the Publisher.*

Venezuela. **Ministro de Guerra y Marina, Caracas.**

Mapa General de Venezuela. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Caracas sheet.—Atlas de Venezuela. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Map No. 12.—Plano Topografico de Venezuela. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheet 12 15.—Carta demonstrativa del progreso de los trabajos del Plano Militar de Venezuela. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles.—Demonstracion de las principales diferencias entre el mapa de Venezuela por Codazzi y el mapa general de los trabajos del Plano Militar de Venezuela. Scale 1 : 1,330,000 or 1 inch to 20·9 stat. miles. Caracas : Ministro de Guerra y Marina, 1907–1909.

These are separate copies of the sheets which appeared in the memoir on the new survey of Venezuela in 1907. The survey was undertaken by the Commission appointed by General Castro, in 1904, when President of the Republic, and the above sheets comprise (1) A general outline sketch showing in red positions determined astronomically by officers of the commissions, with the corresponding positions, in black, as formerly laid down on Codazzi's map, which for many years has formed the only map of the country on anything like a large scale. (2) Part of one of the sheets of the survey on the scale of 1 : 1,000,000, as specimen, showing Caracas and about 150 miles to the south, east, and west. (3) Sheet No. 12 of the 1 : 250,000 scale, with Caracocas, P^to Cabello,

and the country a few miles from the coast. (4) The district between Caracas and the coast, including La Guaira, on the scale of 1 : 50,000. All the sheets are printed in colours, lowlying lands being shown in green, and the hills in brown shading. There are no contours, but heights are occasionally indicated by figures. The second volume of the memoir on the survey with which these sheets were first published gives a very complete account of this important undertaking. After a short historical sketch of the previous maps of the country, it deals with the projection used in the present survey, the determination of the position of the observatory of Cajigal, Caracas, methods of computation, telegraphic determinations of longitudes. It gives also a *résumé* of the positions, barometer, thermometer, and magnetic observations, and other matters.

Hitherto the maps of Venezuela have consisted of compilations from more or less approximate route-traverses and sketches, and nothing like a reliable survey of the country has existed. It is, therefore, to be hoped that this work will not be allowed to fall through, as has been the case with other enterprises of the kind.

GENERAL.

World. **St. Martin and Schrader.**

Atlas Universel de Géographie construit d'après les sources originales et les documents les plus récents, cartes, voyages, mémoires, travaux geodésiques, etc., avec un texte analytique. Ouvrage commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. Sheet 73, États-Unis d'Amerique. Feuille Nord-Ouest. Paris: Hachette & Cie., 1909. *Presented by the Publisher.*

This sheet completes the four-sheet map of the United States published in this atlas on the scale of 1 : 5,000,000. Like the others of the series, it is well drawn and engraved; but, as has been pointed out before in regard to other sheets, owing to the fact that the hillwork and lettering are both in black, many of the names, which are very small, are almost illegible in the mountainous regions, and the map in this part is very confused in its appearance.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during October, 1909. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 645, Plans on the coast of Peru: Lobitos to La Cruz bay, Lobitos cove, Talara bay, 3*s.* 471, Australia, south coast: Port Adelaide harbour, 2*s.*— **New Plans and Plans added.** 1454, Anchorages in Alaska. New Plans: Shumagin islands, English bay, 3*s.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, December, 1909. London: Meteorological Office, 1909. *Price 6d. each. Presented by the Meteorological Office.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic ocean, November, 1909. Washington: U.S. Hydrographic Office, 1909. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, January, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1909. *Presented by the U.S. Weather Bureau.*

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, December, 1909. London: Meteorological Office, 1909. *Price 6d. each Presented by the Meteorological Office.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, December, 1909. Washington: U.S. Hydrographic Office, 1909. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, January, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1909. *Presented by the U.S. Weather Bureau.*

PHOTOGRAPHS.

Egyptian Sudan. **Channer.**

Twenty-four photographic negatives (films) of the Bahr-el-Ghazal, taken by Captain Hugh Channer, R.M.L.I. *Presented by Captain Hugh Channer, R.M.L.I.*

(1) Group of Niam Niam girls, Meridi; (2–4) Young Dinka girls carrying pitchers of water, Lao Post; (5 and 6) Group of Dinka warriors, Lao Post; (7) Dinka girl with pitcher of water; (8) Bakka girl, Meridi; (9) Niam Niam girl; (10 and 11) Group of Niam Niam girls; (12 and 13) Group of Dinka "friendlies" being addressed prior to accompanying a punitive patrol, Lao Post; (14) "Sakia," or water-wheel, Rumbek; (15) Bakka women carrying pitchers, Meridi; (16) Bakka wife of local sheikh; (17) Niam Niam prisoner brought in by local sheikh, Meridi; (18) Bakka girl and dog, Meridi; (19) Native woman; (20) Bakka wife of a local sheikh, Meridi; (21) Niam Niam women, Meridi; (22) Timber bridge built by Sudanese soldiers over the Meridi river; (23) Native dancers, Meridi; (24) Scene on the White Nile.

Mesopotamia. **Willcocks.**

Thirty-seven photographs of Mesopotamia, taken by Sir William Willcocks, K.C.M.G., *Presented by Sir William Willcocks, K.C.M.G.*

As will be gathered from the titles, these photographs have a special historical importance, and give a good idea of the present condition and general characteristic features of this interesting region. Most of them were shown as lantern-slides when Sir William Willcocks read his paper before the Society in November last.

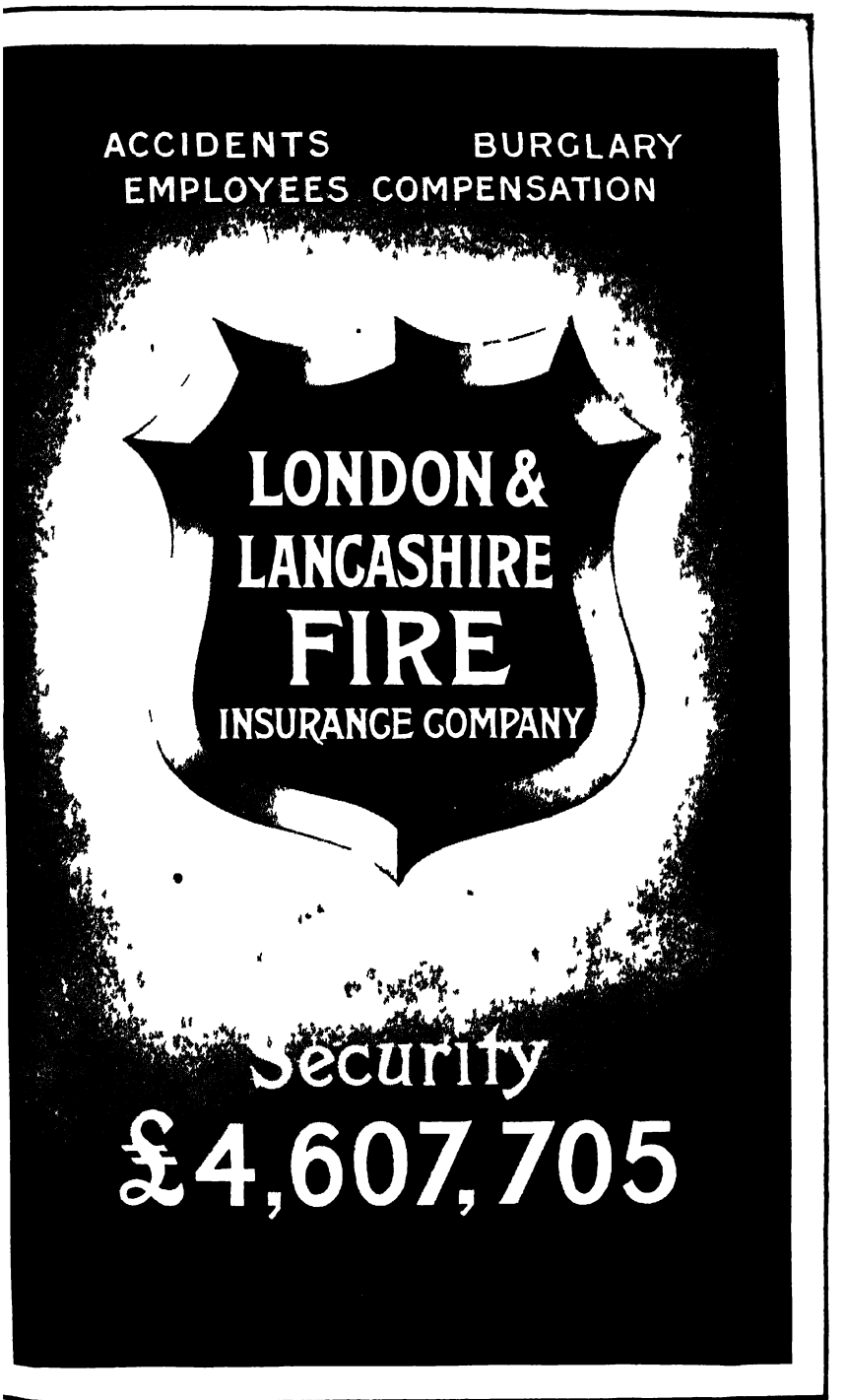
(1–3) Baghdad; (4 and 5) The British Residency, Baghdad; (6) South road, Baghdad; (7) Village on the Tigris, near Ctesiphon; (8 and 9) Ctesiphon; (10 and 11) Nausherwan's palace, Ctesiphon; (12) The gate of Istar, Babylon; (13) Bull from the gate of Istar, at Nebuchadnezzar palace, Babylon; (14–17) Babylon; (18 and 19) Egra's tomb on the Tigris; (20) River Dyala at Bukuba; (21) Kulh Saleh; (22) The entrance to Khan Abu Said; (23) Amara, on the Tigris; (24) Bridge of boats at Amara; (25) The Tigris near the swamps; (26) The water returning from the swamp to the river; (27) The descent into the Adhun river; (28) Samawa, where three Imams are buried; (29) The Euphrates at Kurna, (30) The dry bed of the old Nahrwan; (31) Camp at Khan Nahrwan; (32 and 33) Tigris and Euphrates meeting; (34) Unirrigated Mesopotamia; (35) Irrigated Mesopotamia; (36) Mesopotamian boats; (37) Mounted policeman.

Switzerland. **Vautier-Dufour.**

Vue des Alpes avec mer de brouillards prise du Chasseron. Jura Vaudois. Cliché Vautier-Dufour de Grandson. Ste Croix: Société pour le Développement de Ste. Croix, [1909]. *Presented by M. Aug. Vautier-Dufour.*

The photographs from which this beautiful panorama has been reproduced were taken by M. Aug. Vautier-Dufour, on November 1, 1908, with his new telephotographic lens called the "Telephot," from Chasseron (Vaud) in the Jura, at an altitude of 5277 feet. The complete view consists of ten plates joined together, each measuring 7·09 × 9·45 inches (18 × 24 centimetres), and the exposure allowed was ten seconds for each plate. Above the clouds are seen, in remarkable distinctness, amongst many other important peaks, Mount Semnoz (56 miles distant), Aig. Percée (61 miles), Mont Blanc (71 miles), Dent du Midi (50 miles), Grand Muveran (51 miles), Dent Blanche (76 miles), Dom des Mischabel (87 miles), Balmhorn (62 miles), Jungfrau (70 miles), and Todi (112 miles). Notwithstanding the great distances, the special telephotographic lens brings out the detail in a most remarkable manner, and M. A. Vautier-Dufour is to be congratulated on his success, a success which he states has only been attained after many disappointing attempts, chiefly due to weather conditions.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


ACCIDENTS BURGLARY
EMPLOYEES COMPENSATION
LONDON &
LANCASHIRE
FIRE
INSURANCE COMPANY
Security
£4,607,705

P.T.O.



Fire :

Simple Contracts Latest Concessions

Consequential Loss :

Reimbursement of

Profits Standing Charges -

Increased Cost of Working

Accident

Increased Benefits Optional Schemes

Burglary Plate Glass

Fidelity Guarantee Third Party.

Boiler and Electrical Plant

Employees Compensation

Marine

Registered Post Passengers Baggage.

Specie Insurance Transit Risk

Send for latest terms etc to

London & Lancashire Fire Insurance Co.,

45 Dale Street Liverpool

76 King William Street E C

or any of its 40 Branches.



HOTEL MÉTROPOLE,

Northumberland Avenue, Trafalgar Square,

LONDON.



Of world-wide reputation. Conveniently situated, close to Houses of Parliament, Westminster Abbey, Government Offices, Theatres, fashionable quarters, and chief places of interest. Numerous luxuriously furnished suites of apartments. Most magnificent hotel lounge in London.

Telegrams: "*Métropole, London.*"
Telephone: 8130 *Gerrard* (20 *lines*)

Gordon Hotels, Ltd.

AROSA.

GRISONS, SWITZERLAND.

6000 feet above Sea-level. Splendid Winter Resort. Recommended by the greatest Medical Authorities.

HOTEL SEEHOF. FIRST-CLASS HOTEL.

Finest situation in Arosa on the Lake Specially adapted for English visitors during the winter season Electric light and central heating throughout New drawing-room and billiard-room with English and French billiards.

CURLING RINK IN FRONT OF THE HOTEL. SKI-ING, SKATING, AND TOBOGGANING

PENSION, PRICE, 8-14 FRS

For Prospectus and all particulars apply to the proprietor—

Telegraphic Address —"SEEHOF, AROSA" P WIELAND.

BÂLE. "HOTEL, VICTORIA."

(Quite near Central Railway Station.)

First-class Family House of old reputation Lately quite renewed Fine Large Hall, New Salon, and Conversation Rooms Restaurant. Electric light and central heating in whole house.

NEW BATHS. LIFT. GOOD CUISINE. MODERATE CHARGES.

Managed by the Proprietor—PAUL OTTO

BROWN & ROWLEY

WATLING STREET, CITY,

Printers,

Account Book Manufacturers,

AND

General Stationers.

Contractors to the Royal Geographical Society.

CHOLERA WAS AVOIDED

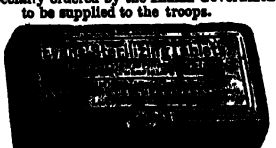
by the BRITISH TROOPS in the recent

MOHMAND CAMPAIGN

by the use of

Evans' Sterilizing Tablets

specially ordered by the Indian Government to be supplied to the troops.



In three sizes, 1s., 1s. 6d. 3s.

Free Sample on application.

Bacteriological reports, and full particulars from the proprietors, 60, BARTHOLOMEW CLOSE, LONDON.



In addition to Visible Writing, the

OLIVER TYPEWRITER

Has a unique, double, down-striking Type-bar of enormous strength that makes it easily the most powerful Manifolder, and the best Typewriter for writing stencils for the Copying Machine or Duplicator. It is a matured machine, strong and durable, powerful and popular, efficient, resourceful, adaptable.

We have a Special Message for

ALL USERS OF TYPEWRITERS.

Send for "SPECIAL PROPOSAL," No. 28, mentioning this *Journal*.

OLIVER TYPEWRITER CO., LTD.,

75, QUEEN VICTORIA STREET,

LONDON; E.C.

By Royal Warrant to H.M. THE KING.

When appetite is dull and you feel the need of something to make your meals enjoyable, just try the effect of a little

LEA & PERRINS' SAUCE.

It is a wonderful appetizer, and assists digestion.

Excellent with MEAT DISHES, FISH, SOUP, GAME, CHEESE, SALADS, &c.

For List of Council and Officers, Conditions of Admission to the Fellowship of the Society, and Society Notices, see pages ii., iv., vi., and viii.

The Geographical Journal.

Authors are alone responsible for their respective statements. In MS. communications all new or unfamiliar geographical names should be written in imitation of Roman type. All communications for the Editor should be addressed to 1, Savile Row, London, W.

CONTENTS—FEBRUARY.

PAGE

The Hispar Glacier (with 7 Plates and Map)—
I. Its Tributaries and Mountains. By Fanny Bullock Workman, F.R.S.G.S., Officier de l'Instruction Publique de France 105
II. Prominent Features of its Structure. By William Hunter Workman, M.A., M.D., F.R.G.S. 115
A Naturalist's Travels on the Congo-Zambesi Watershed. By S. A. Neave, M.A., B.Sc. Oxon (with 4 Plates and Map) 132
The Cycle of Mountain Glaciation. By Prof. William Herbert Hobbs, University of Michigan (with 7 Diagrams and 7 Plates) 146
Survey Work on the Bolivia-Brazil Boundary. By Major P. H. Fawcett, R.A., Chief Bolivian Commissioner 163
Notes on Journeys taken in the Kalahari Desert. By Arnold W. Hodson (with Sketch-map and 4 Illustrations) 166
The Norwegian Sea. By Leon W. Collett 172

Reviews:—
EUROPE—Austria-Hungary. The North European Seas. The Baltic. ASIA—Sikkim and Bhutan. AFRICA—African River Vegetation. The Oasis of Aïr and its Inhabitants. AMERICA—Mexico. Mexico and Yucatan. AUSTRALASIA AND PACIFIC ISLANDS—GENERAL 179

The Monthly Record 193

THE SOCIETY
Commander Peary

EUROPE
Bornholm
Coblenz and its Sphere of Influence
A New Route across the Northern Urals

ASIA
The Apsheron Peninsula
Prof. Saposhnikoff's Latest Journey in the Altai Region
The Port of Dairen (Dalny)

AFRICA
M. Gentil in Western Morocco
M. Villatte in the Sahara
The Pacification of Mauritania
The Nigeria-Kamerun Boundary
The Diamond Fields of German South-West Africa

AMERICA
Swiss Scientific Expedition to Colombia
Height of Mount Huascaran
Standard Time for Chile

AUSTRALASIA AND PACIFIC ISLANDS
The Mountain Flora of Fiji
Prof. R. Neuhauss in German New Guinea
Monument to Bougainville at Tahiti

POLAR REGIONS
Peary and Cook
Amundsen's North Polar Expedition
Government Grant to Captain Scott

MATHEMATICAL AND PHYSICAL GEOGRAPHY
Valley Tracks and Vegetation

Obituary—H.M. King Leopold of Belgium. Colonel George Earl Church. Prof. H. H. Giglioli. Lieut.-Colonel A. E. G. Watherston, C.M.G. 202
Meetings of the Royal Geographical Society, Session 1909-1910 206
Geographical Literature of the Month 207
New Maps 220

MAPS.

Sketch-map—Mr. Arnold W. Hodson's Routes in the Kalahari Desert 167
The Hispar Glacier and Tributaries in the Karakoram Range 224
Map of Northern Rhodesia and Adjacent Territories 224

Sold by

PARIS: Barrère.
VIENNA: Artaria & Co.
HAMBURG: L. Friederichsen & Co.
ST PETERSBURG: Watkins & Co.
MANCHESTER: John Heywood.
EDINBURGH: Douglas & Foulis.
DUBLIN: Hodges, Foster & Co.
BERLIN: D. Reimer.
LEIPZIG: F. A. Brockhaus.
NEW YORK: International News Co.

ROYAL GEOGRAPHICAL SOCIETY.

PATRON.

HIS MAJESTY THE KING.

VICE-PATRON.

HIS ROYAL HIGHNESS THE PRINCE OF WALES, K.G.

COUNCIL.

(ELECTED MAY 24, 1909.)

President—Major LEONARD DARWIN.

Vice-Presidents.

Admiral Sir LEWIS BEAUMONT, K.C.B., K.C.M.G.
Rt. Hon. Lord CURZON OF KEDLESTON, G.C.S.I., G.C.I.E., etc.
DOUGLAS W. FRESHFIELD.
Rt. Hon. Sir J. WEST RIDGEWAY, K.C.B., G.C.M.G., K.C.S.I.
H. YATES THOMPSON, J.P.
Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., F.S.A.

Treasurer—EDWARD L. SOMERS COCKS.

Trustees—Right Hon. Lord AVEBURY, D.C.L., F.R.S.; Lord BELHAVEN AND STENTON.

Honorary Secretaries—Colonel CHAS. F. CLOSE, C.M.G., R.E.; Colonel Sir D. A. JOHNSTON, K.C.M.G., C.B., R.E.

Foreign Secretary—Sir JOHN KIRK, K.C.B., G.C.M.G., F.R.S.

Members of Council.

HENRY BALFOUR, M.A., F.Z.S.
Captain H. H. P. DEASY.
Admiral A. MOSTYN FIELD, F.R.S.
Colonel H. W. FEILDEN, C.B.
Sir WILLIAM EDMUND GARSTIN, G.C.M.G.
Sir DAVID GILL, K.C.B., LL.D., F.R.S.
Rt. Hon. Sir GEORGE D. TAUBMAN GOLDIE, K.C.M.G., F.R.S., D.C.L., LL.D.
Colonel R. C. HELLARD, C.B., R.E.
Sir CLEMENT L. HILL, K.C.M.G., K.C.B., M.P.
Colonel Sir THOMAS HUNGERFORD HOLDICH, K.C.M.G., K.C.I.E., C.B., R.E.
JAMES F. HUGHES.
Rt. Hon. Lord LAMINGTON, G.C.M.G.
Sir GEORGE S. MACKENZIE, K.C.M.G., C.B.
HALFORD JOHN MACKINDER, M.A.
ALFRED P. MAUDSLAY.
Colonel F. R. MAUNSELL, C.M.G., R.A.
Earl of RONALDSHAY, M.P.
Captain R. F. SCOTT, C.V.O., R.N.
Colonel Sir COLIN C. SCOTT-MONCRIEFF, K.C.M.G., K.C.S.I., R.E.
Dr. AUBREY STRAHAN, F.R.S.
Sir EDWARD P. TENNANT, Bart., M.P.

Secretary and Editor of Publications—J. SCOTT KELTIE, LL.D.

Librarian—EDWARD HEAWOOD, M.A.

Map Curator.
EDWARD A. REEVES, F.R.A.S.

Chief Clerk.
S. J. EVIS.

Bankers—Messrs. COCKS, BIDDULPH and Co., 43, Charing Cross.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and £3 as annual "subscription for the current year, and thereafter a yearly subscription of £3, due on the 1st January "of each year; or he may compound either at entrance by one payment of £45, or at any subsequent "period on the following scale, provided that there shall be at the time no arrears due by him to "the Society:—

Fellows of 10 years' standing and under	15	...	£30
,,	15	,,	,,	20	...	£24
,,	20	,,	,,	and over	...	£18 15s.

"No fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear."

All Subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Library and Map-room. Each Fellow is also entitled to receive a copy of all the Society's Periodical Publications.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had on application at the Society's Office, 1, Savile Row, London, W.

POTTER'S

Catalogue (84 pp.) of

Books on Travel and Sport

(chiefly new copies at greatly reduced prices)

SENT POST-FREE.

WILLIAM POTTER,

30, Exchange Street East, Liverpool.

Telephone No. 5197 Gerrard.

MARTIN, HOOD & LARKIN,

MAP SPECIALISTS,

Lithographers and General Printers,

8, Gt. NEWPORT ST., LONDON, W.C.

ALL KINDS OF

Maps, Plans, and Charts.

PERMANENTLY ENLARGED TO 72 PAGES.
MONTHLY 1/- NET.

TRAVEL AND EXPLORATION.

(Edited by EUSTACE REYNOLDS-BALL.)

FEBRUARY, 1910.

Among the Madangs.
DR. CHARLES HOSE.

The Call of the East.
The EARL OF RONALDSHAY, M.P.

Hints on Outfit in the Tropics.
Sir HARRY JOHNSTONE, K.C.M.G.

A Tyrol Holiday.
FRANKFORT SOMERVILLE.

On the Gold Coast.

The South Pole at Last?
"SEARCHLIGHT."

Outfit and Equipment for the Traveller, Explorer, and Sportsman. Part II.

Among the articles arranged for the March number (published February 25th), are—

Recollections of the Siamese-Malay Peninsula. By EDMUND FORBES.
Lines on many Waters. By C. A. PATTON ("Sarcelle" of the *Field*).
Egypt and the English. "SEARCHLIGHT."
The Expansion of the Riviera. By A. S. BROWNE
Travel Photography. By FRANCIS R. BALL.

WITHERBY & Co., 326, HIGH HOLBORN, W.C.

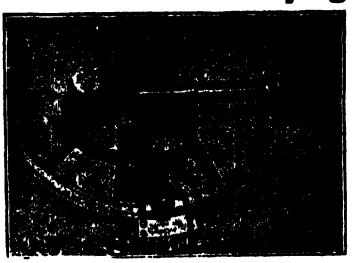
CARY PORTER, LTD. Traveller's Surveying Instruments.

7, PALL MALL, LONDON, S.W.

Established 1765.

BY SPECIAL APPOINTMENT TO THE
Admiralty, War Office, India Office, Ordnance Survey, Crown Agents for the Colonies, Royal Naval and Military Colleges, and other Government Departments.
German, Russian, Japanese, and other Foreign Governments.

FACTORY—FINSBURY PARK, N.



Theodolites,
Sextants,
Artificial Horizons,
Telescopes,
Barometers,
Plane Tables,
Binoculars,
Compasses, etc.

Only maker of Reeves' Patent Endless Tangents and Artificial Horizons.

GRAND PRIZE AND GOLD MEDAL—FRANCO-BRITISH EXHIBITION, 1908.



DOULTON'S

1909 Patent

TRAVELLER'S PUMP FILTER

ASSURES

Pure Drinking Water

Vide *British Medical Journal* and *Journal of Hygiene.*

OBTAINABLE THROUGH ALL STORES AND OUTFITTING HOUSES.

ROYAL DOULTON POTTERIES,
Lambeth, London, S.E.

DELICIOUS COFFEE.

RED WHITE & BLUE

For Breakfast & after Dinner.

NOTICES.*

Ordinary Meetings during February and March.—Monday, February 7. The Geographical Conditions affecting the Development of Australia. By Prof. J. W. Gregory, F.R.S.—**Monday, February 21.** Explorations in and around Lake Chad. By Captain J. Tilho.—**Monday, March 7.** Land and People in the Kasai Basin. By E. Torday.—**Monday, March 14.** Boundary-making on the Bolivio-Brazilian Frontier. By Major P. H. Fawcett, R.A.

Research Department, Friday, February 18, at 5 p.m., in the Map-room. Changes in the Hydrography of the Fen Region. By the Rev. Archdeacon W. Cunningham. Experiments on Rate of Deposition of Matter in Water. By Dr. Owens. Fellows are admitted to these meetings; non-Fellows by invitation.

Special Lectures.—Three Lectures on Waves in Water, Sand, and Snow. By Dr. Vaughan Cornish.—**Thursdays, February 3, 10, and 17,** at 5 p.m. For tickets apply to the Chief Clerk, 1, Savile Row, W.

Year-book for 1909.—The Year-book for 1909 is now ready, and can be obtained on application to the Chief Clerk, 1, Savile Row, W. Price, to Fellows, 1*s.*; to non-Fellows, 2*s.* 6*d.*

Fellows' Reading-room.—The front room on the first floor of the Society's house is arranged as a Reading-room for Fellows. On a few days of the year it will be required for Meetings of the Council, on which occasions a notice will be fixed outside the door of the room.

Any Fellow desiring to have notice of the subjects of papers to be read at the Society's Meetings forwarded to him, can receive such notices by post on payment in advance to the Chief Clerk, at 1, Savile Row, of 2*s.* per session.

* See also pp. vi, viii., and x.

WRIGHT'S
COAL TAR SOAP

is acknowledged as an

ABSOLUTE SPECIFIC

in warding off the bites of

Mosquitos and Other Insects.

"VERB. SAP. ON GOING TO WEST AFRICA," says: "Wright's Coal Tar Soap is good for Prickly Heat and refreshing to the skin."

For Travellers it is packed in an Enamelled Tin Box, containing one Tablet, price 5d.

If any difficulty in obtaining, please write to
The Proprietors of WRIGHT'S COAL TAR SOAP,
48, Southwark Street, London S.E.



SKINNER & GRANT,

TAILORS,

59, REGENT STREET, LONDON, W.

(7 Doors from Piccadilly Circus).

BEST GOODS AT MODERATE PRICES.

Frock Coat and Vest	from	£4	4 0
Morning Coat and Vest	,,	3	10 0
Lounge Suits	,,	3	10 0
Trousers	,,	1	1 0
Overcoats	,,	3	3 0
Dress Suits	,,	5	5 0

MOTOR COATS A SPECIAL FEATURE *A TRIAL ORDER SOLICITED.*

Experience has taught that no expedition may be considered to be completely and thoroughly equipped without a plentiful supply of

BOVRIL

KEEPS GOOD FOR ANY LENGTH OF TIME.

ORIENT CRUISES TO SUNNY LANDS.

PORTUGAL
SPAIN
MOROCCO
ALGERIA
BALEARIC ISLANDS
GREECE
ASIA MINOR
TURKEY
EGYPT
MALTA

By the

S.S. "ORMUZ," 6465 tons register.

FROM LONDON—
25th February to 11th March.

FROM MARSEILLES—
12th March to 8th April.
9th April to 22nd April.

Fares from 13 to 55 Guineas.

Managers { F. GREEN & CO. / ANDERSON, ANDERSON & CO. } Head Office: Fenchurch Avenue, London, E.C.

For Passage apply to the latter firm, at 5, Fenchurch Avenue, London, E.C.; or to the West End Branch Office, 28, Cockspur Street, S.W.



PORTABLE

ACETYLENE LIGHTS.

Easy to carry. **Easy to handle.** **Easy to understand.**

No attention required after lighting.

FOR TRAVELLERS. PROSPECTORS. PIONEERS.

For all Countries and all Climates.

FLARE-LIGHTS each 500 to 5000 c.p. **HAND-FLARES** 250 to 1000 c.p.
Not affected by Weather. Will stand a Gale.

HAND-LAMPS 100 c.p. **HAND-LANTERNS** 20 c.p.

PORTABLE GENERATORS complete in one casing for 2 to 20 lights.

Full particulars from the Patentees and Sole Makers—

C. C. WAKEFIELD & CO., 27, CANNON STREET, **LONDON, E.C.**

NOTICE.

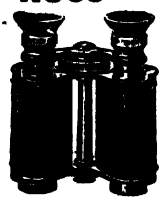
PHOTOGRAPHS.

ROYAL GEOGRAPHICAL SOCIETY

It would greatly add to the value of the Collection of Photographs which has been established in the Map Room of the Royal Geographical Society, if all the Fellows who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they would be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

NO TRAVELLER'S Outfit is complete without
A GOOD TELESCOPE or FIELD GLASS and PHOTOGRAPHIC OUTFIT.

ROSS' New Model PRISM BINOCULARS,
Celebrated TELESCOPES,
FIELD GLASSES, ANEROIDS,
Compasses and all Travellers' requisites.



PHOTOGRAPHIC OUTFITS with ROSS' World-renowned LENSES.

OF ALL LEADING DEALERS.

Explanatory Pamphlets and Price Lists Free by Post on application.

ROSS, Ltd., 111, New Bond St., and 3, Cockspur St., LONDON.
Optical Works: Clapham Common, S.W.

Twin-Lens Camera.
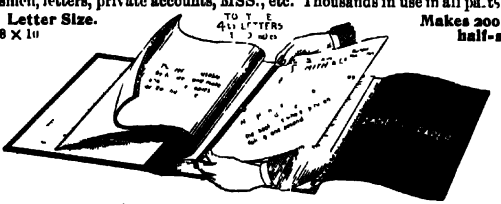


The Zanetic Pat. Copying Book

To copy letters while writing, you simply place your writing paper in the Zanetic copying book and write as usual. The Act of Writing produces the copy. Extremely useful for keeping copies of orders to tradesmen, letters, private accounts, MSS., etc. Thousands in use in all parts of the world.

Order as No. 20/100 Letter Size.
To take letters 8 × 10

4/9 complete
Weight 1lb 14 7
Refills 1/6 each
Weight 12oz

The simplest, yet the most efficient and economical of all copying systems.



Makes 200 full size or 400 half-size copies.

If 200 leaves 5/6, refills 2/3 each. Note size 100 leaves 3/6, refills 1/3 each; or if 200 leaves 3/9, refills 1/6 each.

Samples of Zanetic copying paper free from—

THE PENCARBON CO., Ltd., Wellington Street, LEICESTER.

AT HOME AND ABROAD

"Muscatol" Will PROTECT you from **MOSQUITOES,** Gnats, Midges, **SANDFLIES** and other troublesome insects.

"Quite pleasant to use and clean as Eau de Cologne."

Particulars and Copies of Testimonials sent on request.

Pocket Bottle, 1s. 2d.; Stock Bottles, 2s., 3s. 3d., 5s. 3d., 11s., and 21s. 6d. The "Muscatol" Pocket Spray, 4s. 9d. All post-free.

FRANK A. ROGERS, Chemist,
327, Oxford Street, LONDON, W.

NATURAL HISTORY

WATKINS & DONCASTER
NATURALISTS
36, STRAND, LONDON, W.C.
(Five Doors from Charing Cross)

keep in stock every description of Apparatus, Cabinets, Books, and Specimens for Collectors of

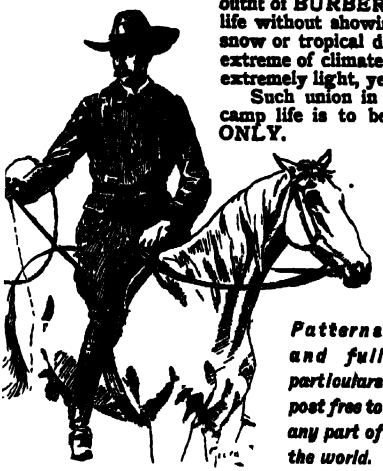
BIRDS' EGGS, BUTTERFLIES AND MOTHS, &c.

Price List sent post-free on application.

BURBERRY GABARDINE
WEATHERPROOF SUITS AND TENTS.

Explorer, Big Game Hunter, Mountaineer, or Colonial with an outfit of BURBERRY has that which will stand the rigours of bush life without showing signs of wear and keep out blizzard-driven snow or tropical downpours. The proofing is not affected by any extreme of climate; it is wind-proof yet faultlessly self-ventilating; extremely light, yet so strong as to be untearable.

Such union in numbers of the great essentials for comfort in camp life is to be found in BURBERRY AND BURBERRY ONLY.



BURBERRY SUIT.

Patterns and full particulars post free to any part of the world.



BURBERRY TENTS.
Extremely light, imperishable, and non-absorbent.

BURBERRYS, 30 to 33, Haymarket, LONDON.

The Best Value on Earth.

Goodyear-Welted BOOTS & SHOES.

Randall's noted "Tenacious" Brand are Goodyear-Welted.

NOTICE.

INSTRUCTION FOR INTENDING TRAVELLERS.

Under the authority of the Council of the R.G.S.

Arrangements have been made for the instruction of intending travellers in the following subjects:—

Surveying and Mapping, including the fixing of positions by Astronomical Observations. By Mr. E. A. Reeves, F.R.A.S., Map Curator of the Society.

Geology, including practical training in the field. Under the superintendence of the Director-General of the Geological Survey.

Botany. Under the superintendence of the Director, Royal Gardens, Kew.

Zoology. By Dr. R. Bowdler Sharpe, Natural History Museum, South Kensington.

Anthropological Measurements. Under the superintendence of Dr. J. G. Garson, Anthropological Institute.

Photography. By Mr. John Thomson, Author of 'Photographic Illustrations of China and its People,' and other works.

Meteorology. By Dr. H. R. Mill.

Outfit and Health. Dr. Charles F. Harford, Secretary of the Travellers' Health Bureau.

The Lessons are given on days and at hours arranged between the Instructor and the pupil. Tickets for the lessons, at 2*s.* 6*d.* for each hour's lesson, must be previously procured at the Offices of the Society.

Silvertown

India Rubber, Ebonite, & Gutta Percha Goods
of all Descriptions.
WATERPROOF GARMENTS and FABRICS.

The India Rubber, Gutta Percha & Telegraph Works Co.,
Limited.

Head Offices - - 106, CANNON STREET, LONDON, E.C.
Works - - - - SILVERTOWN, LONDON, E.

BRANCHES:
HOME: Belfast, Birmingham, Bradford, Bristol, Cardiff, Dublin, Glasgow, Liverpool, Manchester, Newcastle, Portsmouth, Sheffield.
ABROAD: Adelaide, Brisbane, Buenos Ayres, Bulawayo, Calcutta, Christchurch (N.Z.), Durban, Johannesburg, Melbourne, Perth (W.A.), Sydney.

CLARKSON'S
SECOND-HAND OPTICAL MART,
338, HIGH HOLBORN, W.C.
(Opposite Gray's Inn Road).
Sextants, Theodolites, Surveyors' Instruments, Prism Binoculars, Telescopes, and other Second-hand Optical Instruments by the best makers.
Telephone: 2140, Holborn.

All communications respecting Advertisements in the
"GEOGRAPHICAL JOURNAL"
to be sent to
G. STREET & CO., LTD.,
8 SERLE STREET, LINCOLN'S INN, W.C.

Use Odourless or Germicidal
FLORIGENE
(A Registered Name suggested by Floor-Hygiene)
On all School, Laboratory, Library, Museum, Studio, Office, and other Floors—either Wood, Linoleum, Stone, Concrete, or Polished, &c.
—for the anhydrous
LAYING of DUST.
Each application lasts for two to six months, according to wear. The ordinary daily sweeping alone required to clean the floors—no scrubbing (*unless preferred*) or sprinkling of any kind—therefore no injurious moisture.
The "DUST-ALLAYER" Co.,
65, Queen Victoria Street, London, E.C.
Contractors to Admiralty, War Office, H.M. Office of Works, &c.

SUNNY ALGERIA.

A SELECT CONDUCTED TOUR

Will leave LONDON, March 4th, visiting PARIS, MARSEILLES, TUNIS, CARTHAGE, KAIROUAN, CONSTANTINE, BISKRA, SIDI OKBA, BATNA, RUINS OF TIMGAD and LAMBESSA, SETIF, KERRATA, GORGE DU CHABET, BOUGIE.

Carriages through KABYLIA DISTRICT, FORT NATIONAL, MICHELET, ALGIERS, etc.

INCLUSIVE FARE
FIRST CLASS THROUGHOUT } **60 guineas.**

Early Registration Necessary. *Illustrated Booklet Free.*

THOS. COOK & SON,

LUDGATE CIRCUS, LONDON, AND BRANCH OFFICES.

"RONUK" (SANITARY) POLISH.

For effect on Floors, See the National Gallery, Tate Gallery, etc.

Polishes, Preserves, and Purifies Furniture, Floors, Linoleum, etc.



Special Kinds for Glacé and Brown Boots, and Brown and Black Harness, etc.

Highly Concentrated. Use Little and Rub Lightly.

In Tins, 3d., 6d., 1s., and 2s., Everywhere.

'RONUK," LTD., Portslade, near Brighton.

London Depôt: 88, YORK ROAD, LAMBETH, S.E. Manchester Depôt: 285, DEANSGATE.

ROYAL GEOGRAPHICAL SOCIETY.

THE SOCIETY'S PUBLICATIONS.

THE GEOGRAPHICAL JOURNAL. Issued Monthly. Delivered free to all Fellows; price to Non-Fellows, 2s.

GENERAL INDEX TO THE FIRST 20 VOLUMES OF THE GEOGRAPHICAL JOURNAL, 1893–1902. 680 pages, double columns. Price, to Fellows, 6s. 6d. net; to Non-Fellows, 10s. 6d.

JOURNAL OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1830–1880. 50 volumes, 8vo. Price, to Non-Fellows, £1 per vol. net; to Fellows, 15s. per vol.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1855-1878. 22 volumes, 8vo. In parts, to Non-Fellows, 1s.; to Fellows, 9d. per part.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (NEW SERIES), consists of 14 volumes, extending from 1879 to 1892.

Each volume covers on an average 840 pages, the selling price being 18s. per volume. These volumes constitute a record of exploration and geographical work in all parts of the world. In the 14 volumes there are some 350 maps, besides numerous illustrations of characteristic scenery in the least-known parts of the world. It is believed that a complete set of the *Proceedings* would be a valuable addition to public libraries and other institutions, while many private individuals might wish to have the volumes. The series is now offered, bound in cloth, at £6 per set.

SUPPLEMENTARY PAPERS.

Containing a large number of Memoirs and Narratives of considerable length, besides several valuable Bibliographies; over 30 Maps and numerous Illustrations. Sold for half price, £2 for the four volumes.

HINTS TO TRAVELLERS.—The ninth revised edition, edited, under a Committee of the Council, by E. REEVES, F.R.A.S., Map Curator and Instructor to the Society. Price 15s. net; to Fellows, at the House of the Society, 10s.

TRIGONOMETRY—PLANE AND SPHERICAL. Specially arranged for the use of Students attending the Royal Geographical Society's course of Instruction. By E. A. REEVES, F.R.A.S. Price 5s. net.

HINTS ON OUTFIT FOR TRAVELLERS IN TROPICAL COUNTRIES. By CHARLES FORBES HARFORD, M.A., M.D. Price 1s. 3d. net.

CATALOGUE OF THE LIBRARY OF THE R.G.S. Edited by Dr. H. R. MILL. Price, to Fellows, 2s. 6d. net; to Non-Fellows, 5s.

THE YEAR-BOOK OF THE SOCIETY. Issued annually. Price, to Non-Fellows, 2s. 6d.; Fellows, 1s.

SYLLABUSES OF INSTRUCTION IN GEOGRAPHY. I. In Elementary Schools. II. In Secondary Schools. Single copies gratis on application at 1, Savile Row, W.

EXTRA PUBLICATIONS.

THE FIFTY YEARS' WORK OF THE ROYAL GEOGRAPHICAL SOCIETY. By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., President. 255 pp. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

THE LANDS OF CAZEMBE. LACERDA'S JOURNEY TO CAZEMBE IN 1798. Translated and annotated by Captain R. F. BURTON. 271 pp., with Map. Also JOURNEY of the Pombeiros, P. J. Baptista, and Amaro José, across Africa from Angola to Tette on the Zambeze. Translated by B. A. BEADLE. And a *Résumé* of the Journey of MM. Monteiro and Gamitto. By Dr. C. T. BEKE. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

THE TOPOGRAPHY OF THE BATTLE OF PLATÆA. By G. B. GRUNDY, B.A. Price, bound in half-calf, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

NOTES ON THE KURIL ISLANDS. By Captain H. J. SNOW. 8vo, 88 pp., with two large Charts, revised by Captain SNOW. Price, in boards, to Non-Fellows, 4s. net; to Fellows, 2s. net.

EASTERN PERSIAN IRAK. By General A. HOUTUM-SCHINDLER. 8vo, 132 pp., with Map. Price, to Non-Fellows, 5s. net; to Fellows, 3s. net.

A JOURNEY ON THE UPPER MEKONG, SIAM. By H. WARINGTON SMYTH. Sixty Illustrations and three Maps. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 4s. net.

BIBLIOGRAPHY OF ALGERIA, FROM THE EXPEDITION OF CHARLES V. IN 1511 TO 1887. By Sir R. L. PLAYFAIR. Price, to Non-Fellows, 7s. 6d.; Fellows, 5s. net. [net.

EDUCATIONAL REPORTS. By Dr. J. SCOTT KELTIE. Price, to Non-Fellows, 5s.; to Fellows, 2s. 6d.

SUPPLEMENT TO THE BIBLIOGRAPHY OF ALGERIA, FROM THE EARLIEST TIME TO 1896. By Sir LAMBERT PLAYFAIR, K.C.M.G. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

MAP OF THE KARAKORAM HIMALAYAS. In two sheets, with text. By Sir W. MARTIN CONWAY, M.A. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

SURVEYING AND EXPLORING IN SIAM. By JAMES MCCARTHY. Large Maps of Siam and many Illustrations. 236 pp. 8vo. Price, to Non-Fellows, 10s. 6d. net; to Fellows, 6s. 6d. net.

THE DISTRIBUTION OF RAINFALL OVER THE LAND. By Dr. A. J. HERBERTSON. Price, to Non Fellows, 5s. net; to Fellows, 2s. 6d. net.

ON THE RESULTS OF A DEEP-SEA SOUNDING EXPEDITION IN THE NORTH ATLANTIC DURING THE SUMMER OF 1899. By R. S. PEAKE, M.INST.C.E. With Notes on Temperature, Deep-Sea Deposits, &c. By Sir JOHN MURRAY, K.C.B., F.R.S. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

ARCTIC PAPERS FOR THE EXPEDITION OF 1875. A selection of Papers on Arctic Geography and Ethnology. Reprinted and presented to the Arctic Expedition of 1875, by the President, Council, and Fellows of the Royal Geographical Society. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 5s. net.

THE ANTARCTIC MANUAL, FOR THE USE OF THE EXPEDITION OF 1901. Edited by GEORGE MURRAY, F.R.S. 662 pp. royal 8vo. Price, to Non-Fellows, 15s. net; to Fellows, 10s. net.

JOURNEY TO LHASA AND CENTRAL TIBET. By SARAT CHANDRA DAS, C.I.E. Edited by the Hon. W. W. ROCKHILL. Maps and Illustrations. 285 pp. 8vo. Price, bound in cloth, to Non-Fellows, 10s. 6d. net; to Fellows, 7s. net.

NEW MAP OF THE RIVER CONGO, in Ten Sections on Five Sheets. Scale 1 : 500,000 (8 miles = 1 inch). By the Rev. GEORGE GRENFELL. In small portfolio, with Memorandum. Price, to Non-Fellows, 10s. net; to Fellows, 6s. net.

ON RECENT CONTRIBUTIONS TO OUR KNOWLEDGE OF THE FLOOR OF THE NORTH ATLANTIC OCEAN. By Sir JOHN MURRAY, K.C.B., F.R.S., and R. E. PEAKE, M.INST.C.E. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

AN EXPEDITION INTO THE CENTRAL TIAN-SHAN MOUNTAINS. By Dr. GOTTFRIED MERZBACHER. Price, to Non-Fellows, 12s net; to Fellows, 9s. net.

MAP OF TIBET. New edition, 1906. Price, to Fellows, 8s. net; to Non-Fellows, 5s. net.

GEOGRAPHICAL DISTRIBUTION OF VEGETATION IN SOMERSET. By Dr. C. E. MOSS. Price, to Fellows, 2s. 6d. net; to Non-Fellows, 5s. net.

BIBLIOGRAPHY OF TOPOGRAPHICAL AND GEOLOGICAL WORKS ON THE PHLEGRÆAN FIELDS. By R. T. GÜNTHER. Price, to Fellows, paper covers, 2s. 6d., boards, 3s. net; to Non-Fellows, paper covers, 5s., stiff boards, 6s. net.

NATIONAL ANTARCTIC EXPEDITION, 1901–4. Charts of the Expedition, with Memoir by Lieut. G. F. A. MULOCK, R.N. Price, to Non-Fellows, 12s. 6d. net; to Fellows, 9s. net.

MOUNTAIN PANORAMAS FROM THE PAMIRS AND KWEN LUN. With Introduction and Descriptions by Dr. M. AUREL STEIN. Price, to Non-Fellows, £1 net; to Fellows, 14s. net.

BATHYMETRICAL SURVEY OF THE FRESHWATER LOCHS OF SCOTLAND. Under the direction of Sir JOHN MURRAY, K.C.B., F.R.S., and LAURENCE PULLAR, F.R.S.E. Maps and Illustrations. Price, to Fellows, 15s.; to Non-Fellows, 21s. net.

J. & J. LEIGHTON, BOOKSELLERS AND BOOKBINDERS,

ESTABLISHED 1798. **40, BREWER STREET,** Golden Square, Regent Street, London, W.

Illuminated MSS., Incunabula and other Early Books with Wood-cuts, Bookbindings of Historical and Artistic Interest, etc., etc.

ILLUSTRATED CATALOGUE, 7,500 items, with upwards of 2,060 facsimile reproductions in line and half-tone, with full descriptions and bibliographical information.

SPECIMEN PART WITH PROSPECTUS, POST FREE ON APPLICATION

PROVISIONS AND OUTFIT.

GRIFFITHS, McALISTER & Co.,

EXPORT PROVISION MERCHANTS, ETC.,

29–31, Manesty's Lane, Liverpool. 14, Billiter St., London, E.C.

Suppliers of all kinds of Provisions, Camp Equipment, Medical Stores, Wines, Spirits, and Mineral Waters, &c., for Exploring and Mining Expeditions; also for private use abroad.

All Goods suitably packed for Hot and Cold Climates, and made up in loads suitable for all modes of Transport.

Suppliers to Lieut. Shackleton's Antarctic Expedition, 1907–1909.

CONTRACTORS TO THE CROWN AGENTS FOR THE COLONIES.

Telegraphic Addresses: "COOMASSIE," LIVERPOOL. "APPRAISABLE," LONDON. Codes used: A, B, C, 4th and 5th Editions and Lieber's

ESTABLISHED 1880.

ROYAL GEOGRAPHICAL SOCIETY.

EXTRA PUBLICATION.

Mountain Panoramas from the Pamirs and Kwen Lun,

WITH INTRODUCTION AND DESCRIPTIONS

By Dr. M. AUREL STEIN.

IN BLUE CLOTH CASE, GILT.

Price, to Fellows of the Society, 14s. net; to non-Fellows, 20s. net.

LONDON:

ROYAL GEOGRAPHICAL SOCIETY, 1, SAVILE ROW, W.

EDWARD STANFORD, 14, LONG ACRE, W.C.

CLOTHE THE SKIN

When buying a Ventilated Garment, do not simply ask for Cellular, but ask for

AERTEX Cellular

LOOK FOR THIS OVAL LABEL

THE CELLULAR CLOTHING Co. LTD. AERTEX LONDON

LOOK FOR THIS OVAL LABEL

so as to make certain you get the genuine and original make.

BEWARE OF IMITATIONS SOLD UNDER SIMILAR NAMES.

AERTEX Cellular Garments are made from a cloth composed of small cells, in which the air is enclosed. The body is thus protected from the effects of outer heat or cold, while the action of the pores of the skin is not impeded.

ILLUSTRATED PRICE LIST of full range of AERTEX CELLULAR goods for Men, Women, and Children, with list of 1 500 Depots where these goods may be obtained, sent Post Free on application to THE CELLULAR CLOTHING Co., Ltd., Fore Street, London, E.C.

ROBERT SCOTT, Ltd., 8, Poultry, Cheapside, E.C.
OLIVER BROS., Ltd., 417, Oxford Street, W.

USED BY DOCTORS and the PUBLIC for OVER HALF-A-CENTURY.

Dr J. Collis Browne's Chlorodyne

The ORIGINAL and

The Best Remedy Known for

COUGHS, COLDS, ASTHMA, and BRONCHITIS.

Acts like a Charm in

DIARRHŒA, CHOLERA, and DYSENTERY.



ONLY GENUINE.

Admitted by the Profession to be the **MOST VALUABLE REMEDY** ever discovered.

Effectually cuts short all attacks of **SPASMS.**

The only Palliative in **NEURALGIA, TOOTHACHE, GOUT, RHEUMATISM.**

Convincing Medical Testimony accompanies each bottle.

SOLD IN BOTTLES BY ALL CHEMISTS,
at 1/1½, 2/9, and 4/6 each.

INDEX TO ADVERTISEMENTS.

Where no number is given, the Advertisement does not appear this month.

Account Book Makers. PAGE
Brown & Bowley 15

Bookbinders, Booksellers, &c.
Leighton, J. & J. 11
Sotheran & Co. ..... *Cover* 2

Boots and Shoes.
Dowie & Marshall 13
Goodyear-Welted 7

Cutlery.
Hill & Son ....

Electrical Engineers.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd. ... 6

Electric Lighting.
Tredegar & Co. ....
Wakefield & Co. 5

Filters.
Doulton & Co., Ltd. 3

Foods for Travellers.
Bovril 5
Oxo 14
Plasmon ....
Red, White & Blue Coffee 3

Fountain Pens.
Waterman's Ideal Fountain Pen

Furniture and Floor Polish.
Ronuk, Limited 9

Hotels and Restaurants.
Hôtel Métropole 15
Hotel Scalot, Arcos 15
Hotel Victoria, Bale 15

Instruments for Travellers.
Cary, Porter, Ltd. 3
Clarkson & Co. 8

Insurance.
Eagle Insurance Co. ....
London and Lancashire ..... *Insect*
Scottish Provident Institution ...
Scottish Widows' Fund ....

Medicines & Medicine Cases. PAGE
Browne, Dr. Collis 12
Burroughs Wellcome & Co. ....
Elmsford & Co. ..... *Cover* 2
Evans, Lescher & Webb, Ltd. ...
Muscatol 6

Naturalists.
Watkins & Doncaster 6

Outfitters.
Cellular Clothing Co. 12
Dowie & Marshall 13
Griffiths, McAlister & Co. 11
Silver, S. W., & Co., and Benjamin Edgington ..... *Cover* 4
Thresher & Glenny ....
Tucker, Joseph 13

Photo Engravers.
Bale, Sons, & Danielsson, Ltd. *Cover* 2

Photographic.
Burroughs Wellcome & Co. ....
Marion & Co., Ltd. ....
Rose, Ltd. 6
Sinclair, J. A., & Co. ....
Stereoscopic Co. ....

Publishers.
Constable & Co., Ltd. ....
Johnston, W. & A. K. ....
Macmillan & Co., Ltd. .. ..
Philip, G., & Son, Ltd. ....
Potter, Wm. 3
Stanford, Edward ....
Travel and Exploration 3
Witherby & Co. 3

Railways.
Great Central Railway ....
Great Eastern Railway ..... *Cover* 4

Razors.
Kropp Razor ..... *Cover* 2

Soaps. PAGE
Wright's Coal Tar 4

Sporting Outfits.
Burberrys 7

Stores for Expeditions, &c.
Griffiths, McAlister & Co. 11
Silver, S. W., & Co., and Benjamin Edgington ..... *Cover* 4
Spratt's Patent, Ltd. ....
Tucker, Joseph 13
Wilkinson Sword Co. ....

Stoves.
Poore, Wm., & Co. 15

Tailors.
Skinner & Grant 5

Tents.
Burberrys 7
Piggott Bros. & Co., Ltd. ....
Silver, S. W., & Co., and Benjamin Edgington ..... *Cover* 4
Tucker, Joseph 13

Tobacco.
Player & Sons ....

Tours and Excursions.
Cook, T., & Son 9
Orient Line 5

Turkish Baths.
Nevill's, Charing Cross ..... *Cover* 3

Typewriters.
Oliver Typewriter Co., Ltd. 16
Remington Typewriter Co. ....

Wines and Spirits.
Dents & Geldermann .. ..
Heidsieck, Charles ..... *Cover* 3
Martell & Co. ..... *Cover* 4

BOOTS FOR EXPLORERS.



(REGISTERED AT STATIONERS' HALL.)

DOWIE & MARSHALL

(Established 1894)

Have for many years made a special study of the various kinds of boots required for different climates, and they have had the gratification of pleasing many Travellers, including members of the R.G.S., from the time of Dr. John Rae of Arctic renown to Sir H. M. Stanley, the African Explorer.

Country Customers should send, as guide to measurement, a pair of old boots and outlines of the feet.

Only the best hand-sewn Boots are made.

455, WEST STRAND, LONDON.

P.O. Telephone No. 9015 Central. (3 doors from Trafalgar Square.)

IF YOU ARE GOING ABROAD

CALL UPON

JOSEPH TUCKER

AND INSPECT

his large and varied stock of TROPICAL CLOTHING, CAMP FURNITURE and EQUIPMENT, STORES, and every requisite for travel and residence abroad.

79, Newington Green Road, LONDON, N.

SHIPPING AND PASSENGER AGENT,

Contractor to H.M. and the Dutch Governments.

Telegrams: "T bula, London." Telephone: 2131 Dalston.

YOU CAN INSURE YOUR

Art Treasures, Family Heirlooms, &c.

AGAINST FIRE, BUT

Can You Replace Them?

THOUGH

"Dreadnought" Fireproof Doors

cost no more than Wood Doors and are of ordinary appearance, thickness, and weight, they have been able to withstand a temperature of 2000 degrees for 2½ hours. No hinged door of such a size has withstood

HALF AS GREAT AN OFFICIAL FIRE TEST AS THIS.

Supplied to the Government for

The Admiralty, National Gallery, Victoria and Albert Museums, Imperial College of Science, Imperial Institute. Also Birmingham Telegraph Office; to Edinburgh Law Courts, Royal Insurance Company, Cox's Bank, &c., &c.; to Lord Lilford, and many private mansions.

Write for full particulars to

"G.J." DEPT., FIREPROOF DOORS, Ltd.,

46, KING WILLIAM STREET, LONDON, E.C.

NEAR THE SOUTH POLE.

Sir E. H. Shackleton's Christmas Dinner.

In Sir E. H. Shackleton's great book, "The Heart of the Antarctic" (Heinemann)—the most fascinating book ever published on Polar exploration—appears the following tribute to OXO.

"We had a splendid dinner. First came "hoosh, consisting of pony ration boiled up "with penguin and some of our OXO and "biscuit. Then in the cocoa water I boiled "our little plum pudding, which a friend of "Wild's had given him. This, with a drop of "medical brandy, was a luxury which Lucul-"lus himself might have envied; then came "cocoa, and lastly cigars and a spoonful of "creme de menthe sent by a friend in Scot-"land. We are full to-night, but this is the "last time we will be for many a long day."

OXO

OXO, 4, Lloyd's Avenue, London, E.C.

The
Geographical Journal.

No. 2. FEBRUARY, 1910. Vol. XXXV.

THE HISPAR GLACIER.*

I. ITS TRIBUTARIES AND MOUNTAINS.

By FANNY BULLOCK WORKMAN, F.R.S.G.S., Officier de l'Instruction Publique de France.

'When I last had the pleasure of reading a paper before this Society in 1905, I showed a view of J. Petigax, C. Savoye, and myself standing under the reversed cornice, on top of the Alchori col, 17,000 feet, at the source of the Alchori glacier. We made the first ascent of this col with the hope of finding a caravan-passage on the north side to the Hispar glacier. Our disappointment at finding a cornice overtopping a sheer precipice of 2000 feet was mitigated by the wonderful view vouchsafed us of the north Kanibasar tributary of the Hispar, and a galaxy of magnificent peaks at its head. Some scenes spread before the explorer possess a strange allurement which remains fixed in memory, and that picture clung to mine, and I determined, if possible in the future, to visit the Hispar and its branches.

As I stated in my last paper, we had failed to find a caravan-passage to the Hispar on several occasions, both on three cols ascended from the Chogo Lungma branches, which, had they proved feasible, would have led to glaciers accessible to it, and on three points from the Alchori, which would have taken us over its great south wall. I said then I believed the only caravan-pass to it over the south watershed to be the Nushik La. Presently I shall have something more to say of this col as a practicable passage at the present day. Thus, having found we could not reach Hispar by a new, proper, mountaineer's pass, we decided

* Read at a Meeting of the Royal Geographical Society, December 6, 1909. Map, p. 224.

in the summer of 1908 to accept the commonplace, and approach it from the Gilgit road, called eighteen years ago by Knight the Siberia of Kashmir.

Intending to remain six to eight weeks in that region, do some detailed surveying of the main glacier, and particularly of the north tributaries not visited by Sir Martin Conway, it was decided to take a topographer with the expedition. Our friend M. Charles Rabot of Paris consulted Prof. J. Brunhes, of the Fribourg University, who recommended two of his former pupils, Comte Dr. C. Calciati and Dr. M. de Koncza, both of whom had had experience in glacial topography in the Alps. The two being desirous of the opportunity offered to do some Himalayan work, the services of both were accepted. Our old Italian guide of three Himalaya seasons, C. Savoye, and three Courmayeur porters, also accompanied us.

Two or three large caravans a year, only, being allowed to proceed towards the Pamirs, a permit from the Indian Government was necessary. Colonel Sir Francis Younghusband, resident in Kashmir, kindly undertook to arrange this matter, and we have to thank him for varied assistance and instructions given to officials both in Hunza-Nagar and later in Baltistan. Our friend the late Major G. Bruce, then political agent in Gilgit, was most kind in arranging six months in advance with the Mir of Nagar for a supply of grain and the contingent of coolies to accompany us on the glaciers. We were prevented from greeting and thanking him for his valuable aid by the inexorable decree of fate, and in Gilgit had only the mournful satisfaction of placing roses on his newly made grave.

The 240 miles of road separating Srinagar from Gilgit is no longer quite the Siberia depicted by Knight. It is a monotonous, dreary, and, at times, torrid enough stretch of country, but the road is a splendid tribute to the skill and energy of the engineers who built it, and who for years have seen to its constant maintenance, and the traveller has only to give the rein to his pony until he gets there, which is no special hardship to those accustomed to Himalayan travel. Two marches beyond Gilgit, at Chalt, the Hunza-Nagar country is entered, and here we were met by Sher Mohamed Khan, assistant to the political agent, who took charge of all arrangements for the further marches to Nagar. Just beyond Chalt, that famous peak Rakapushi, called by all Hunza-Nagar people Domani, bursts into view, a glorious 18,000 feet of sharp, gashed and séracked snow-slopes, culminating in abrupt ice-glazed pinnacles. To my mind it is a more impressive, grander mountain than Nanga Parbat. The Mir of Nagar was to have met us a few miles before the village, but we arrived six hours earlier than was expected, and were already inspecting the camping-bagh below the palace, when he came hurrying down with a numerous suite to welcome us. He is a slim, fair-skinned, intelligent-looking man, with brown eyes and aquiline nose, and quite

European in his dress. He brought his two bright-eyed little sons to see us.

The afternoon was passed in going over all the previous agreements for grain, sheep, and coolie-supply for the glacier work. He was to arrange for a constant band of sixty to seventy coolies, who every two weeks were to be changed off for a relief-corps.

The next morning, escorted to the outskirts of Nagar by the Mir, Wazir, and Khan, our large caravan in charge of a lambardar and military levy, left for Hispar village, 29 miles distant, whither the European agent and the topographers had preceded us by three weeks. Soon after leaving Nagar, the tongue of the Hopar glacier is crossed, and the narrow valley through which the Hispar river descends followed. It is encased on both sides by steep slopes composed of alternating strata of alluvium, sand, and gravel, interspersed with various-sized boulders, to a height of perhaps 2000 feet above its bed, upon which are superimposed tali of like materials fallen from peaks still higher up, through the whole thickness of which the river has cut its path, leaving the rough walls either vertical or descending to it in abrupt inclines.

These walls are broken at intervals by deep ravines washed out by floods, and avalanches of rock and sand constantly erode them, filling the air with dust. As the valley widens at times, a series of terraces of similar make-up are met with. The whole vale for many miles below Hispar presents a scene of utter desolation. The small path, often quite obliterated, and again barely wide enough for one's feet, winds up and down the barren spurs or over the edge of creepy precipices, to near the alluvial fan upon which Hispar village stands. At Hispar we stayed only long enough to reorganize our loads, interview the topographers who came down to meet us, and visit the Hispar tongue, which descends to 1½ mile above the village.

I would here refer to the Yengutsa glacier, the tongue of which, as well as that of the Hispar, was thoroughly examined by Mr. H. H. Hayden in 1906, on behalf of the Geological Survey of India. The Yengutsa tongue descends at present to within 2952 feet of the Hispar river, and Hispar village lies only about 754 feet east of it. Dr. Calciati made a survey on the scale of 1 : 20,000 with the "règle à eclimètre" of the part, including the tongues of the Yengutsa and Hispar, and so carried further the survey begun by Mr. Hayden.

As points of study for the Yengutsa, he and Dr. Koncza took the same two pyramids marked in black G.S.I., adding in red the initials B.W. and date of our expedition of 1908. Having previously possessed themselves of the facts reported by Mr. Hayden, their examinations show that this glacier remains about as he found it in 1906, manifesting only a small decrease in thickness and length. They report a recession of 98·9 feet, as measured carefully from the line of pyramids on either

side of the cañon. This figure has reference to the time of their departure only, the end of August, and they regard such a light retreat as due probably only to the summer contraction. It will be remembered that this is one of the glaciers examined by Mr. Hayden, which five years previous to his visit is said by the natives to have suddenly advanced with great rapidity, a distance which Mr. Hayden, referring to Sir Martin Conway's map, judges to have been about 2 miles. A further advance of this glacier might cause incalculable damage to the meagre wheat-fields of the inhabitants, who, as it is, find hard lines to subsist at all.

In regard to the Hispar, our topographers found the Geological Survey pyramids placed on both sides of the river at the tongue. Near the one on the right bank, they marked the red letters and date of our expedition on a large erratic boulder, repeating this marking on a polished rock near the Geological Survey pyramid of the left bank. They report the shrinkage in the end of the Hispar tongue as not exceeding 30 feet, so that the Hispar may be said to be stationary at present. By the end of August they noticed, however, that the depth of the tongue was much reduced, many large blocks of ice having fallen down and been carried away by the sub-glacial stream.

On July 4 we left Hispar. The weather having turned very fine, it was decided to ascend on the orographical left bank to the Haigatum glacier, and visit it and the Nushik La. This col—for I cannot to-day call it a pass—had a special interest for us, as in 1903 we had wished to cross it from Baltistan, but had been baulked in so doing by the Basha coolies, who had refused to ascend to it from the Kero Lungma. For many years it was spoken and written about as a passage for natives and even animals between Baltistan and Nagar, but when such reports as exist are sifted, there appears to be no history of any authentic crossing until 1892, when four members of Sir Martin Conway's party traversed it to the Basha valley. In 1861, Colonel Godwin Austen ascended from the Kero Lungma to its top, but did not descend it on the Haigatum side. Likewise, Major Cunningham followed later, reaching the summit, but, finding a cornice and steep ice-wall beneath it, retraced his steps. In 1896 Dr. A. Neve tried to cross from the Kero Lungma, but was obliged to turn back.

After camping beyond the entrance on the left bank of the Haigatum glacier, we ascended 600 feet on the arête above to examine the col. From here it was apparent that the sharp wall leading to the Nushik La was so difficult from its gradient and the kind of snow covering it, and so exposed to avalanches, which constantly fell from the overhanging snow-cornice running from end to end of its apex, that it would be tempting providence to attempt its ascent. More to the east, the slopes of a snow mountain, while in places steeper, schrund-cut, and overhung by great stratified cornices, led to a large white mamelon high above



FIG. 1 PEAKS COVERED WITH HANGING GLACIERS ABOVE BUMARU GLACIER



FIG 2.—WHITE MAMELON COVERED WITH NIEVES PENITENTES, 19,000 FEET, AT TOP OF ICE-WALL ABOVE HAIGATUM GLACIER, EAST OF THE NUSHIK COL

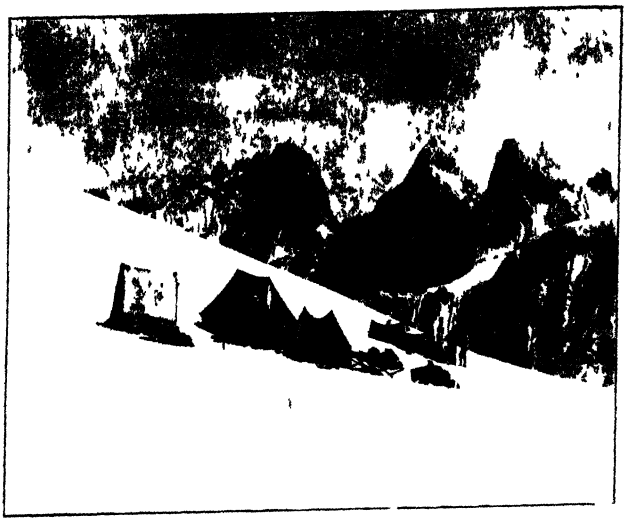


FIG. 3 CAMP AT 19,100 FEET ON FLANK OF BIAFO HISPAR WATERSHED PEAK, FROM WHICH ASCENT WAS MADE



FIG. 4.—UNTITLED PHOTO OF HIGH PEAK OVERHANGING THE JUNCTION OF PAK GLACIER WITH THE HISPAR

the Nushik La, and this route we decided to try, with the guide and porters only. We should here reach an elevated brow in the depression, and overlook the region on both sides.

The levy and coolies, when asked what they knew of a pass from this glacier, replied that they had heard there was one, but had no personal knowledge of it. To ensure any reasonable surety to life, it would be necessary to start very early, in order to be down on the glacier again by noon, at which time the daily and continuous avalanche-cannonade started in from all slopes at the head of and above the east side of the glacier.

As there are other things to speak of to-night, I will not give a detailed account of the climb carried out from the camp, here seen near the source of the glacier. The dangerous ascent and descent was made between 2 a.m. and 12 noon. An hour or two spent on such scarps as seen in the view was a feature of the climb. Several times, whenever we dared to halt, the clinometer was used, and in each case, the angle of graduation of 60° being exceeded, failed to register. The slopes here and at other points were probably at an angle of 70°. Mr. O. Eckenstein, using Sir Martin Conway's clinometer, graduated to 46°, estimated an angle of $52\frac{1}{2}°$ on his ascent—obviously, as Sir Martin says, an error. The slants we ascended surpassed any such angle. At a point above the snow scarps we found again the interesting *nieves penitentes* first observed by us in Himalaya in 1906 in the Nun Kun. While not very high, from 18 to 24 inches, they were perfect specimens of this curious snow-phenomenon.

Next the white mamelon, height 18,000 feet, which overlooks the Nushik col by 1200 feet, is seen. Its north face presents a nearly perpendicular ice-wall, below which spreads a huge starfish-like bergschrund of unknown depth.

The route we took to the mamelon, the only one feasible at present, is strenuous enough for mountaineers, and cannot be regarded as practicable in any way for a loaded caravan. It would not have been possible to induce our Nagar coolies to follow us loaded up the appallingly steep and dangerous face we ascended. A descent can be made from the mamelon to the Kero Lungma, the ascent to the Nushik from Baltistan being quite possible for loaded coolies. The guide Zurbriggen appears, in 1892, to have ascended to a point well below the mamelon, but also east above the Nushik col, and thence crossed to the other side. In all respects the route, as he then found it, was, apparently, much easier than we found it in 1908, but that may be accounted for in the changed ice and snow-conditions in the last sixteen years. Such changes are known to occur in Himalayan passes, several instances of which might be cited. When one reflects on the mighty natural forces always at work in great mountain regions, particularly in the higher Himalaya, where wind, snow, and water are building up, tearing down, and washing out, with

a rapidity unknown in the Alps, this is not surprising. In our own experience of the last ten years in Asia, on revisiting certain places, distinct differences in the obstacles met with have been observed.

Above the mamelon east a fine snow-peak rose about 1000 feet in a series of slants separated by snow-terraces. This peak we climbed to within 20 feet of its apex, where from a small ice-ledge three ice-cornices rose straight above us, like the monster teeth of some petrified Himalayan mammoth of bygone ages. Savoye used his ice-axe for twenty minutes on the first one, and then reported that, owing to hard ice, it would take two hours to cut through them to the top. It was 10 a.m., and, in view of the dangerous avalanche-swept descent to the glacier, we decided to leave out the last 20 feet of cornices, for the mountain was really a *fait accompli*. We named the mountain (height, 19,000 feet) Triple Cornice peak.

I would here mention that our heights of peaks, passes, and camps, as on previous expeditions, were taken by boiling-point readings compared with simultaneous ones taken at a lower Government station—in this case at Gilgit—three times daily for us during the summer.

This view of the mamelon was taken on the descent. Scarcely stopping to breathe, the dangerous downward climb was made amid the boom of avalanches, which fortunately spared our party, and camp was reached by 12.30. To quote the opinion of a mountain-expert, Savoye remarked, *en route* to the lower camp, that he should not care to repeat that climb, as he had not felt easy in his mind from two in the morning until after noon.

The chief northern tributaries of the Hispar are the Lak, the Pumarikich, the Jutmaru, and the Kanibasar, and on the south the Haigatum and the Makorum. A survey with theodolite by Dr. Koncza, and with the "règle à eclimètre" of the Gaulier type employed in the French Army Topographical Service by Dr. Calciati, was made for us of these glaciers, and, in addition, many stereoscopic and panoramic views taken in connection with this work. I believe I am correct in saying that this is the first time that detailed glacial surveying by the methods employed of recent years in the Alps, America, and elsewhere, has been carried out in the Himalaya. They found the above glaciers join the Hispar by a regular slope without the intervention of a terrace, with the exception of the Pumarikish, which is connected by terraces. They report, as do we, no practicable passage between any two of the branch-basins.

Of our first exploration of the fine north tributaries, the Jutmaru and Kanibasar, respectively 9·3 and 5·6 miles long, I would say a few words as to their general character. In view of generally accepted ideas on nomenclature, that names known best to natives should be taken for glaciers and mountains, we have been forced to substitute

on our map the name Jutmaru for the glacier marked Kanibasar on Sir Martin Conway's, transferring the name Kanibasar to the higher branch, of which Sir Martin said in 1892 "there appeared to be no name." The Hispar natives accompanying the topographers, and Nagar coolies with us, whenever asked, distinctly stated that they knew these glaciers only by the names referred to, and in the order placed on our map.

As my province to-night is to mention mountain-forms rather than glacial features, I would say that both these branches are surrounded by high, picturesque but inaccessible snow and rock-peaks, often decked by hanging glaciers ending in such abrupt, savage ice-falls that it seemed as if the slightest earth-tremor would precipitate them in shattered ice-blocks to the main stream. The apices of these extraordinary peaks are in many instances festooned with fantastic double and triple cornices, perpetuating here on the frontier in snow-sculpture the weird figures, such as yalis and three-hooded cobras, of South Indian temple-architecture. Both glaciers widen near their sources into snow-basins, and we found, as did the topographers, the reservoir of the Jutmaru to be the more extensive. From that of the Jutmaru two steep tributaries branch east and west about 2 miles in length. These again end in rock-walls several thousand feet high, connecting more high peaks garlanded with furrowed and riven ice-falls, from which avalanches constantly fall.

The long longitudinal moraine-ridges on this glacier in places reach a height of 100 feet, while between them the white ice ascends gently, crevassed, presenting picturesque undulating bands. We found on this and on the Kanibasar many surface streams, some difficult to ford, one on the Jutmaru being, when we crossed it, quite 50 feet wide. Our tallest man sank into it above the waist. It was coated with frozen slush, presenting a firm enough surface to enable us, by throwing ourselves flat, to crawl across by aid of our ice-axes placed in front.

Our duty as mountain-students was to climb cols for observation-points, but neither on the main glaciers nor on their branches could feasible slopes or ridges be discovered. The only one accessible to human feet was on the right bank of the Jutmaru, and this col overlooked a limited region of no geographical importance. This is the first branch on the left of the Kanibasar, the only one of any account.

To return to the Hispar. The only trees growing there at present are dwarf-willows. Cedars evidently formerly grew, as in a few places their dead trunks were found, but no living cedars were seen. The wood-growth limit is at about 14,500 feet, somewhat higher than on the Chogo Lungma glacier. The snow-line, on the contrary, is lower than we found it on the Chogo. After many observations we placed it on south slopes at not over 16,500 feet, while on northern ones it is, of course, considerably lower.

Passing by the still higher, equally interesting north branches of the Hispar, I must ask you to follow me on an ascent made from the highest base, called "Coolies' Paradise Camp," 15,900 feet, situated on the last moraine-ridge below the Hispar pass on the right bank. We have explored three out of four of the longest Himalayan glaciers, and on the Hispar found the greatest number of inaccessible peaks. I do not recall one on the north boundary high enough to afford a view of importance which is climbable, and certainly not one crowning the south snow-wall for 20 miles is even approachable.

To the north of the Hispar pass, and separated from it by 3 or 4 miles of ascending snow-fields and gashed ice-falls, rises a very sharp triangular pyramid-peak. The snows of its east side feed the Biafo and Snow lake; those of the south-west and west flanks contribute to the Hispar reservoir, hence the name, Biafo Hispar Watershed peak, which was given it. It is seen for 20 miles on the Biafo glacier, overtopping Snow lake to the west. From the Haigatum branch onward, always fore-shortened, it is visible from the left of the Hispar. The mountain had a singular attraction for me, for I knew that from its summit not only a grand view could be had, but one of much topographical interest. Three arêtes diverged from its pointed top, sweeping down precipitously 2000 to 3000 feet, of which the west and south ones looked impracticable of ascent, but the east had yet to be studied.

On August 1, with eighteen coolies under the lambardar, we left camp early, climbing the long, frozen slopes to the south of the pass. A day or two previous a new relay of Nagar coolies had taken the place of a bad lot who had returned, and we feared the new set would handicap the possible ascent of the mountain. After three hours' climbing, the peak came into full view, and we saw that the long ridge must be contoured, then a sharp ascent made to a high basin between the south and east shoulders. The caravan was still behind. We continued on to the base of a steep 800-feet wall, which, if surmounted, would bring us to the scoop between the arêtes, and render the peak probably within reach the next day. Making a solid zigzag path, we had climbed about 500 feet when the caravan arrived at the base.

The bearer called up that the coolies would not attempt the wall. We replied that they must. Then the lambardar harangued them, but in vain. Finally, Savoye went down to see what he could do. After he had talked a while, to our surprise, three of the loudest Nagaris attacked him with their spiked sticks. In self-defence he struck one of them over the back with his ice-axe, felling him to the snow. That settled the matter. They all subsided, and began to file slowly upward. This was the first time they had attacked the guide, and the first and only time a coolie was struck by our Europeans. The lambardar often used his stick on coolies; but that was the Mir's affair, not ours. Later, some of them reached the small snow-flat where we waited, while others



FIG. 5.—MOUNTAINS FORMING WEST WALL OF BIAFO GLACIER JUST BELOW THE POINT WHERE THE GREAT HISPAR-BIAFO WALL CHANGES ITS COURSE SUDDENLY FROM EAST TO SOUTH, ON WEST SIDE OF THE SO-CALLED SNOW LAKE.

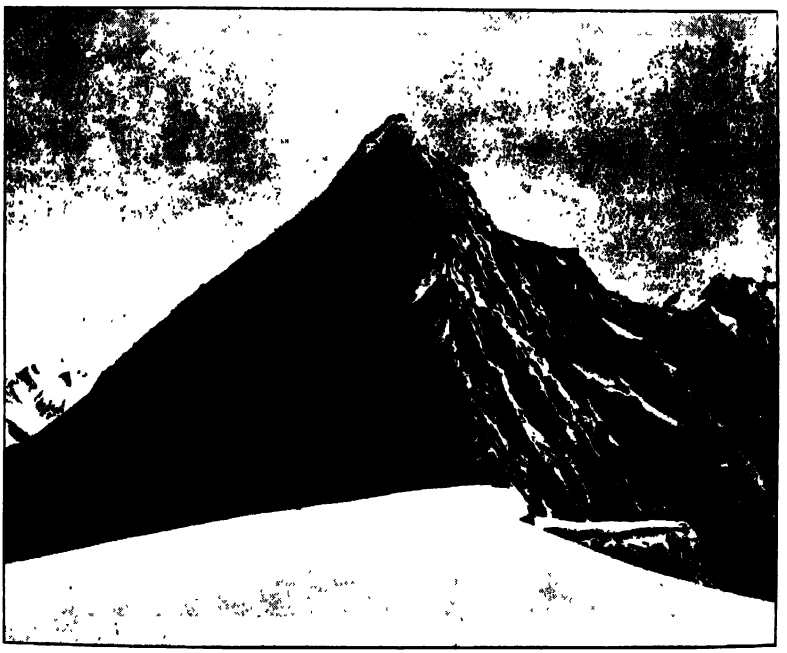


FIG. 6.—HISPAR-BIAFO WATERSHED PEAK, 21,350 FEET, MRS. BULLOCK WORKMAN AND TWO GUIDES SEEN ON SUMMIT. PHOTOGRAPHED BY DR. WORKMAN FROM A NEIGHBOURING PEAK.

stopped short of it, allowing the porters to return and bring up their loads. We were, however, very glad to reach this spot, the height of which, later computed, was 19,100 feet. Savoye and one porter went off to examine the east shoulder, which was found impossible because of a fluting of cornices. The only solution was the south, much sharper arête facing the Hispar pass.

While still clear the next morning, the sky had a filmy look, indicating a storm before night, so all haste was made to secure the peak before a change came. With the guide and two porters, I left for this mountain; while later Dr. Workman and the third porter started for a lower peak east, overlooking Snow lake.

Crossing the intervening slopes, we ascended a steep snow-wall leading directly to the arête. This arête was ice-glazed, and at most 18 inches wide, ascending at an angle beyond 60° for some distance. To the right of it sank the wall just ascended, and sheer to the left a deeper seemingly endless abyss, filled with the gloom and mountain intangibility of early morning. Cutting each step, we climbed steadily for an hour to some gendarmes, which gave us a little rock-work. Beyond these a gentler gradient brought us to the base of a blue ice-wall about 15 feet high. Here we had some food. It was still fairly clear toward the Biafo, but toward the Hispar mist floated in, so Savoye at once began step-cutting on the wall, which we took sideways, each foot only half in a step. Below lay two-thirds of the mountain, a tortuous, precipitous mass, inviting to instant death should head or feet fail. The long, glistening arête was hailed again, rising sharper than ever, making every movement more arduous. Finally, this came to a climax, and the top was seen just ahead, a small cone turning over to the north in a cornice. Crossing an easier slope, then climbing a short narrow ridge, we arrived at a group of spiked rocks. From here, in five minutes, the cone was ascended, and, with the others holding the rope, I stood on the cornice, and saw one of the most remarkable and comprehensive panoramas I have beheld in Himalaya.

This single pyramid stands alone, with no near higher peak to mar the view on any side. Eastward, 5000 to 6000 feet beneath, lay Snow lake, its glacial branches spread like white fans, clearly defined, framed each by its border ranges. Beyond this swept, still further east, a great glacier fully 15 miles, behind the B 15 range, to the base of a high snow-wall which joins the east perpendicular slopes of the peak, 23,900 feet, which ten years ago we named Kailasa No. 2. Miles beyond, the Baltoro giants, K_2, the Mustagh Tower, Gusherbrum, and the Golden Throne caught the eye. Following south-east, the Biafo sank downward many miles, until lost behind dark mountain-flanks. Straight across, beyond the south ridge of the Hispar, I saw the wide void, beneath which, 2000 feet below, lies Cornice glacier, first discovered by us from the Col des Aiguilles at the head of the Hoh Lumba in 1903. The wall and mass

of peaks cutting it off absolutely from the Biafo on the east, and the great avalanched walls separating it from the Hoh and Sosbon glaciers on the south, were clearly seen, as were the cols we had climbed on these glaciers.

The western boundary formed by the Alchori mountains we followed up in 1903, and found no opening. I was thus able from this peak to obtain evidence confirming our observations made in 1903, that Cornice glacier lies in a deep hollow with no observable outlet at any point. We have examined its barriers on every side—and I believe it to be an example of what Sir M. Conway says cannot exist, an enclosed glacier. West, though clouds were rushing in, 20 miles of the Hispar were visible; and beyond it, partly snow-swathed, I recognized Pyramid peak on the Chogo Lungma and the sublime form of Domani. North of west stretched range after range of wild, unmapped mountains, beyond the frontier, and in the foreground of these rose what, from its charted position, appeared certainly to be the highest Kunjit peak No. 1, 25,492 feet. For a minute it was a glorious vision, but I recall it only as a stage phantom, for a dark purdah of mist fell between it and me.

I had seen wonders not of earth, the memory of which will cling while life lasts. Knight aptly called his book, 'Where Three Empires meet.' My eyes beheld at a glance on that day the whole magnificent mountain-landscape encompassing the meeting-places of three of Asia's greatest glaciers.

The other party was seen on their peak 1800 feet below, and from there Dr. Workman photographed us on the summit. A band of mist entwined itself about our cornice, and one-half the mountain world was lost in a sea of cloud. The others told later of the striking picture we presented: three black figures encircled by a cloud-wreath, not standing on a peak at all, but hung high in a heaven of incoming mist and storm.

We retreated to the rocks below, where instruments were noted and the record of the ascent left in a box, and, having hastily eaten something, began the descent, as an icy wind chased the mist backward, leaving a few steps of our path clear. It was a slow and dangerous descent through fog and cloud-billows, down the unending precipitous arête. But camp was safely reached, where the others greeted us with bravos of approval.

The height of the peak, since carefully computed, is placed at 21,350 feet. Savoye hoped it would be nearer our highest Nun Kun climb of over 23,000 feet, but, as I told him, we did not come to the Hispar to break records. This and the other climb are the first ascents to date of high peaks overlooking Snow lake, the Hispar pass, and the Biafo, and I am satisfied with all, except the storm that suddenly interfered with many photographs I wished to take.

Ten days later we crossed the Hispar pass to the head of Snow lake. I would here refer to Sir M. Conway's review of our book 'Ice-bound Heights of the Mustagh,' in the July, 1908, *Geographical Journal*, in which he says of Cornice glacier, just mentioned, "This glacier is a tributary of the Biafo." On his map he makes a large tributary enter Snow lake through its western wall at the point shown in this photograph. No break occurs in the wall here, and no glacier enters either here or for many miles further down, through the western Biafo wall. Our observations of the wall on its western side from Col des Aiguilles and mine from the Watershed peak, show conclusively that Cornice glacier is not a tributary of, and has no connection whatever with, the Biafo.

We wished to cross the Biafo and ascend the glacier east of B 15 to see if a caravan passage could be discovered to the Punmah glacier, but not a coolie could be persuaded to enter on the journey. Savoye and a porter went alone to the end of the east glacier, which they found closed. They then took a north branch, and ascended a steep col at its head, from which they saw a glacier flowing in the direction of the Punmah, as placed on existing maps, but the sharp col, heavily covered with new snow, was found quite impossible for coolies. By using snow-shoes on the glacier, and marching from 6 a.m. till midnight, they were able to make these observations. We ended our summer's exploration by descending the Biafo, reaching Askole August 27.

II. PROMINENT FEATURES OF ITS STRUCTURE.

By WILLIAM HUNTER WORKMAN, M.A., M.D., F.R.G.S.

Among the ice-bound heights of the Karakoram, in one of the most snowy of Asiatic mountain-regions, in a parallelogram bounded by 35° 40′ and 36° 20′ lat. N. and 74° 50′ and 76° 40′ long. E., lies a group of four of the world's greatest mountain-glaciers, three of which, the Biafo, the Chogo Lungma, and the Hispar, with many of their branches, have been explored from end to end by Mrs. F. Bullock Workman and myself.

Born amid the howlings of the tempest and the roar of the avalanche, in inaccessible fastnesses far above the habitations of man or animals, and fed by large tributaries themselves glaciers of the first order, these vast rivers of ice force their way downward through the intervals between precipitous mountains for many miles into the deep valleys below, where, succumbing to the heat there encountered, they gradually die out and disappear. The waters into which all of them are finally resolved find their way into that remarkable river, the Indus.

These great glaciers are not mere bands of snow and ice running smoothly from their sources to their tongues, but they are most

complicated structures descending in steep, broken ice-falls covered with splintered séracs or thrown up into huge undulations, ridges, and high hillocks, seamed by unfathomable crevasses, and bearing on their surface or within their substance an incredible amount of *débris* from the decaying mountains, whose crests they fringe with fluted snow-ruffles and whose flanks they rasp away and sculpture out in their downward progress.

From the similarity of their environing conditions these glaciers have many features in common, but each has also distinctive features sufficiently marked to render a comparative study of them all of engrossing interest.

We are considering this evening the Hispar glacier, the most northerly of the group. The tongue of this glacier is first encountered 2·1 kilometres (1·5 mile) east of Hispar village, at an altitude of about 3354 metres (11,000 feet). It is a broad, *débris*-covered, discoloured mass of ice, with irregular surface sloping down to the detritus-strewn valley-bed where it ends. A large torrent, issuing from an ice-cave on its southern side, has cut a passage for itself through the rock-*débris* to the valley below. This is joined at the extremity of the tongue by a smaller stream descending in a sulcus between the north side of the tongue and the ragged edge of a large alluvial fan radiating from a gorge in the mountains opposite.

From here the glacier ascends with a gentle gradient in a direction somewhat south of east for 59 kilometres (36·63 miles),* to the highest point of the Hispar pass lying at an altitude of 5335 metres (17,500 feet), where it meets the upper extremity of the Biafo glacier. Its average width above the tongue is about 3 kilometres, 1·95 mile. In the lowest 25 kilometres (15·53 miles) of its course it receives on its south, or orographical left side, six branches, three of them large, the highest being the Haigatum; but from here to its culmination in the Hispar pass no branch enters it on that side. On the north side, nine branches, six of which are large, enter it at various points along its course. Most of these branches, but particularly the northern ones, are laden to an unusual degree with *débris*, the effect of which is manifested on the main trunk.

The mountains enclosing the Hispar, especially its upper half, as well as its branches, are high, greatly broken, very steep, and heavily covered with ice and snow. Their crests and summits are largely crowned with huge, overhanging cornices, many of them of great thickness and stratified in numerous layers. These, when they break

* Drs. Calciati and Koncza consider the length of the Hispar glacier to be 56·6 kilometres, which, as measured on their map, corresponds to the point where their route-line ends. By repeated altitude observations while crossing it, I found the highest part, or summit, of the Hispar pass to be 2·4 kilometres beyond or east of this point, viz. at 59 kilometres.—W. H. W.

away, give rise to avalanches of immense size, on account of which it is dangerous to approach the bases of the mountains, where avalanche beds cover the edge of the glacier.

The southern barrier of the Hispar extends from the Haigatum glacier to the summit of the Hispar pass, a distance of 34 kilometres (21·1 miles), without a break. It consists of a high, continuous wall, rising at intervals into sharp peaks, the whole covered with snow, masses of ice, glaciers, and hanging glaciers, and surmounted by cornices, which frequently break loose and shower down avalanches on the glacier below. These avalanches score and chisel out its icy flanks into deep furrows, sharp ridges, battlements, and spires, which, combined with the frozen cataracts and flutings of the hanging glaciers, present a most weird and bizarre effect in the changing shadows which chase one another across the face of the wall, as the sun marks the hours in its westerly course. In our six expeditions in Himalaya, we have seen no ice-expanse that approaches it in extent, complexity, and grandeur. On account of the size and frequency of the avalanches falling from it, its base cannot, at any point, be approached with safety.*

For a distance of 24 kilometres (14·9 miles) above the tongue, the whole of the Hispar surface is broken into ice-hillocks separated by deep depressions and heavily coated with *débris* of every size from mud and sand to granite blocks 6 to 15 metres (20 to 50 feet) in diameter. Many of the hillocks have the form of symmetrical cones and pyramids, but many more have a perpendicular ice-wall on the one side and on the other slant back to the glacier at an angle of 45° or less. This formation is more pronounced and extends up the glacier to a greater distance than the similar formation on the Chogo Lungma, which has a length of 14·5 kilometres (9 miles), or that on the Biafo, which only reaches to a point about 5 kilometres (3·1 miles) above the end of the tongue.

A short distance below the entrance of the Haigatum branch a narrow band of smooth, white ice appears among the *débris*-covered hillocks, which stretches upward, becoming ever broader, till it merges in the white ice pressing down along the left or southern side of the glacier. On the north side the hillocks persist for 18 kilometres (11·5 miles) farther to the entrance of the Kanibasar branch. Above the Haigatum many of them are oblong in shape and are arranged in lines, their long diameter being coincident with the lines; but below the Haigatum such arrangement is less apparent. They vary in height from 15 to 70 metres (48·9 to 229·6 feet), but some, as will later be

* About 5 kilometres (3 miles) beyond the Hispar pass, the wall makes a sharp turn to the south and continues on, also unbroken, as the west wall of the Biafo glacier, for 24 kilometres (15 miles) farther. It thus forms a continuous barrier 64 kilometres (40 miles) in length, unpierced by a single glacier though extending through a region of snow and ice

stated, exceed the latter height. Throughout the hillock-area, although the glacier carries such a vast amount of detritus, no well-marked median moraines are observable, the continuity of the moraine-material being destroyed by the broken condition of the surface.

From the edge of the hillock-area to the ice-falls below the highest part of the glacier the surface consists of fairly smooth, somewhat rolling, white ice, bearing only a moderate amount of *débris*. On the north side this section is only a few kilometres in length, reaching from the Kanibasar glacier upward; but on the south side it extends well downward toward the Haigatum branch.

The last and highest portion of the glacier forms the Hispar pass. This is a plateau of *névé* 5 kilometres (3·11 miles) long and about the same in width, covered with driven snow, unbroken by crevasses, and gently rising to a snow-ridge crossing its eastern end from north to south. The highest part of this ridge, near its termination in an ice-shoulder descending from the last snow-peak above the Hispar on the south, was measured by boiling-point readings, compared with simultaneous ones at the Government Station at Gilgit, at 5335 metres (17,500 feet). This ridge is the summit of the pass, and from it, on the east, one steps down upon the most westerly of the three heads of the Biafo glacier, between which and the Hispar it forms the line of demarcation. The gradient of descent of the Biafo from the ridge is much sharper than that of the Hispar.

North of the pass and east of Last Moraine branch of the Hispar lies a large snow-clad region, extending back 5 to 8 kilometres (3 to 5 miles), and sloping upward some 760 metres (2500 feet) above the Hispar pass. This is bounded and intersected by peaks and ridges, the highest of the former of which reaches an altitude of 6509 metres (21,350 feet), and forms a part of the watershed between the Biafo and Hispar glaciers. We entered this region at two points, and explored it to its northern enclosing walls. It sends down to the Hispar its highest northern branch, a large snow and *névé*-covered glacier, named by us the Névé branch. This region is one of the largest contributors to the Hispar stream, and the ice and snow from it break down into the latter in a chain of tumultuous ice-falls.

The reservoir of a glacier consists of a basin or basins usually enclosed by mountains and the highest portion of its own structure, which collect the snows that contribute to its formation. The dissipator is the lower portion, of varying extent, where melting exceeds the ice and snow-supply, and where, therefore, the glacier wastes away. The Hispar reservoir comprises the greater part of the region just mentioned, the whole of the Hispar pass to the highest summit-snow-arête, and the whole northern slope of the great southern Hispar mountain-barrier for a distance downward of 33·5 kilometres (20·8 miles) to the opening of the Haigatum branch.



FIG. 1.—THE FACE OF THE SNOW-REGION DIRECTLY NORTH OF THE HISPAR PASS AS VIEWED FROM A POINT ON SOUTH SIDE OF PASS OPPOSITE CENTRAL PEAK. THE PEAK IN CENTRE IS THE BIAFO HISPAR WATERSHED PEAK, 21,360 FEET (6509 METRES). SNOWS ON THE RIGHT (EAST) OF THE CENTRAL MASSIF DESCEND TO THE EAST INTO THE BIAFO GLACIER. THOSE IN FRONT AND TO THE LEFT (WEST) OF IT INTO THE HISPAR. WEST HEAD OF BIAFO DESCENDS BETWEEN THE SNOW-RIDGE AND ROCK-FACE AT EXTREME RIGHT. THE NORTHERN HEAD OF BIAFO PASSES NORTH BEHIND THE ROCK-FACE AND SNOWY RIDGE LEADING BACK FROM IT.

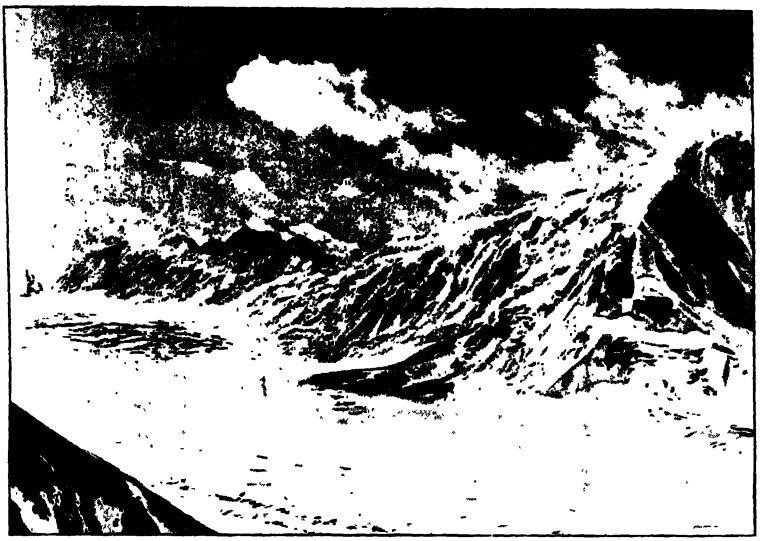


FIG. 2.—THE UPPER 19·3 KMS. (12 MILES) OF THE GREAT ICE-COVERED WALL FORMING THE SOUTHERN BARRIER OF THE HISPAR GLACIER. IT EXTENDS FROM THE HAIGATUM BRANCH TO THE HISPAR PASS, A DISTANCE OF 34 KMS. (21·1 MILES) WITHOUT A BREAK; THENCE 4·83 KMS. (3 MILES) BEYOND AS THE SOUTH WALL OF THE WESTERN HEAD OF THE BIAFO GLACIER TO A POINT, WHERE IT MAKES A SHARP BEND TO THE SOUTH, AND CONTINUES ON, STILL UNBROKEN, FORMING THE WESTERN BARRIER OF THE BIAFO GLACIER FOR 24 KMS. (15 MILES) FURTHER, WHEN IT IS PIERCED FOR THE FIRST TIME BY A LARGE BRANCH ENTERING THE BIAFO FROM THE WEST. THE TOTAL LENGTH OF UNBROKEN WALL IS ABOUT 64 KMS. (40 MILES).



FIG. 3.—A BORDER-LAKE NEAR THE JUNCTION OF THE JUTMARU WITH THE HISPAR GLACIER, IT IS ENCLOSED BY A LATERAL MORAINE AND THE MOUNTAIN-WALL ON THE RIGHT, AND THE HIGH SIDE OF THE JUTMARU GLACIER ON THE LEFT, FROM WHICH THE ICE-FRAGMENTS FLOATING ON THE WATER ARE DERIVED. THE STRATIFICATION OF THE BLACKENED GLACIAL ICE IS WELL SEEN. BEHIND ARE THE HIGH SNOW-PEAKS WALLING IN THE JUTMARU.

The powerful pressure from the north exercised by Névé branch, aided by that of Last Moraine and the large Kanibasar and Jutmaru branches, forces the glacier over bodily hard against its southern wall, which pours down a constant succession of glaciers, ice-falls, and avalanches over the line of contact, covering it so completely that the glacial surface, sloping upward into that of the wall, forms as intimate a connection with it as does that of any glacier with that of its initial reservoir. At no point in this long distance can any interval be seen between the edge of the glacier and the wall.

A remarkable circumstance connected with this is, that for 26 kilometres (14 miles) above the Haigatum branch the main part of the glacier opposite this ice-wall, excluding a comparatively narrow section adjoining the wall, serves as a dissipator, all loose snow, and, indeed over much of it, all *névé* being melted away in late summer. Also the northern edge of the glacier throughout this section, in complete contrast with the southern edge, has so melted away that it lies at a considerable distance from the mountain-slopes, which themselves are at that season free from snow.

A peculiar feature of the Hispar, not observed on the Biafo or Chogo Lungma, is the great number of lakelets scattered over its surface, especially in the hillock-area. From any point somewhat raised above the glacier a dozen or twenty in the immediate vicinity may readily be counted. With their transparent water, of beautiful green or reflecting the deep blue of the sky, they flash in the sunlight like emeralds and sapphires from their setting of brown and grey. The great majority of them are merely collections or pools of water occupying the depressions between the hillocks; but some of the larger are highly picturesque, their cleft, scarred, and banded ice-barriers, in places thickly covered with rock-*débris*, enclosing beautifully curved bays, between which graceful crystal promontories project, and their surfaces dotted with islets of ice or partly submerged boulders. These lakelets are seen even in the *névé*-area to as high an altitude as 4878 metres (16,000 feet). They are formed by the settling of the water resulting from surface-melting into the depressions. Very few of those observed were fed by streams even of small size, and few had outlets. There was a notable absence on the glacier of streams of running water, the greater part of the surface-water apparently finding its way into the lakelets. . Few large streams, such as exist on the Biafo, were seen.

Besides these surface-lakes, many border-lakes and a few subglacial ones were found at the lateral edges of the Hispar and its branches, resulting from the damming of water by ice or moraine-barriers. Some of these, their surfaces flecked with miniature icebergs interspersed among projecting boulders, in their setting of mountain and glacier, formed pictures of great beauty. These lakes were more interesting to observe than to negotiate. On several occasions we were obliged to

cross the beds of border-lakes recently drained, when we had the pleasure of wading through soft, sticky mud, ankle-deep, that cleaved to our boots in great, unwieldy balls.

The existence over the lower two-thirds of the glacier of such a large number of surface-lakes implies an absence of crevasses, or, at least, the presence of very few, for, did any considerable number exist, the lakes either would not form at all or would be quickly emptied. This inference was shown by observation to be correct in fact. Notwithstanding the extreme irregularity of the surface, few crevasses of any size were seen in this area.

Crevasses are usually caused by steepness or irregularity of the glacier-bed, and are intimately associated with ice-falls. Only one series of ice-falls occurs on the Hispar, viz. in the section near its head, where it descends sharply from the Hispar pass to the level of Last Moraine glacier, into which section the northern portion of its reservoir tumbles, also in ice-falls. Here large crevasses occur, though many of them are not deep. From Last Moraine glacier to its tongue the Hispar descends in an even, regular stream with a gentle gradient. In the 20·5 kilometres (12·7 miles) from the upper edge of the Kanibasar junction to the lower edge of the Haigatum junction it falls about 305 metres (1000 feet) or 1 : 67 metres or feet. This, together with the absence of crevasses, points to the conclusion that the glacial bed is practically smooth.

Now, in the case of a simple glacier without affluents, with a smooth bed of uniform breadth and gentle gradient, we should expect to find its surface smooth, even if bearing moraine. How, then, does it happen that the surface of the Hispar, where both the last two conditions obtain, is so universally broken up, over the detritus-covered portions, into high hillocks separated by deep depressions? The answer to this question can only be found in the effect on the glacier of its branches.

The four moraine-bearing branches on the north side above the Haigatum, coming from high mountains, exert a tremendous pressure on the main stream, forcing it over bodily, as has been stated, against the ice-covered mountain-wall on the south side. Being prevented by the wall from yielding any more, and being compressed into the smallest possible space, the main stream resists further encroachment on the part of the branches.

Under such circumstances, what next happens depends on the resisting power of the ice to compression as compared with the pressure brought to bear upon it. If the former be greater than the latter, the branch simply turns in a curve into the space from which it has pushed the main glacier, and moves downward side by side with the latter with a smooth surface, as is the case with the large Haramosh branch after its junction with the Chogo Lungma. If, however, as is the case here, the

pressure is greater than the resisting power of the ice, the ice is obliged to yield still farther, which it does in the direction of least resistance, *i.e.* toward its free surface, and is folded up into ridges and protuberances having a size and height proportioned to the excess of pressure over resistance, till an equilibrium is established.

Owing to the conditions existing at the lines of impact of the branches upon the main stream, the direction of pressure varies at different points, and in consequence ice-hillocks, many of them of great size, are formed instead of long ridges. While some of these, as already stated, take the forms of symmetrical or oblong cones and pyramids, their contours probably rounded somewhat by the heat of sun and air, the shapes of others in the hillock area indicate that, under the severity of the pressure, the ice composing them bursts asunder and forms a fault, one portion being crowded high above the other as a perpendicular ice-cliff shelving back to the glacial surface on the farther side. This process occurs most markedly in the upper layers of the ice, the lower ones, so far as can be seen, remaining in solid contact without the development of deep crevasses.

The hillock-formation first appears at the line of junction of the Kanibasar branch with the main stream, developing in the Kanibasar area as it moves downward. At the entrance of the Jutmaru it becomes more accentuated, the pressure here being evidently increased, and the broken surface extends upward into the Jutmaru itself for some 3 kilometres, nearly 2 miles, while it also spreads out laterally farther over the Hispar, encroaching still more on the area occupied by the white ice. The pressure is augmented at the junction of each succeeding lower northern branch.

The entrance of the Haigatum and the five lower branches on the south side now introduces a new factor of active counterpressure, thereby enormously increasing the compressing force to which the ice is subjected. The effect of this manifests itself immediately. The white ice, which after the junction of the Jutmaru branch narrows rapidly, and opposite Haigatum is reduced to a slender tongue, just below this point is completely overwhelmed and disappears from view. From here to the end of the Hispar, a distance of 24 kilometres (14·9 miles) only a chaos of detritus-covered hillocks is seen. These, which higher up were more or less arranged in lines, are here thrown into disorder by the variety of opposing forces. They are also crowded up to a greater height, and, opposite the Makoram branch, their apices rise 85 metres (278·8 feet) above their bases.

The similar, though much less pronounced, formation existing at the lower ends of the Chogo Lungma and Biafo glaciers appears only after the lateral pressure on their streams has been increased by the junction of large branches and narrowing of their beds. A reach of typical hillocks was found at the middle third of the Biafo, in the area of a large

western branch entering at that place, but it disappeared lower down. At and below the junction of the Alchori glacier with the Kero Lungma, the former descending rather sharply on the latter, a similar crowding up of the surface was observed in 1903, the elevations presenting some of the largest, highest, and most impressive, ice-slants I have anywhere seen on a glacier. The hillocks here were composed of ice bearing but little moraine-material.

A notable instance of this formation exactly paralleling the Hispar hillocks, and by no means yielding the palm to them in size or height, as it was larger than any of those observed on the Hispar, was mentioned by me, in a paper before this Society in November, 1907, as met with in the Nun Kun.* This was only a single hillock, but its genesis by pressure was all the more apparent on that account. It occurred at the line of impact on the Shafat glacier of a short branch falling some 2750 metres (about 9000 feet) directly from two high peaks. It was covered thickly from bottom to top with black detritus, while the side of the Shafat, which was opposing its advance, was clothed with red granite detritus, so that the area occupied by each was clearly marked. This instance and the hillock-area of the Hispar were particularly favourable to the study of this process, as it was not complicated by the presence of ice-falls or séracs in either case.

The pressure of most of the branches at the line of their first contact with the Hispar acts upon the latter in a direction nearly or quite perpendicular to its axis. As the branches, under the pressure from behind and the resistance of the main glacier in front, turn in great curves toward the west and align themselves with the main trunk, the pressure is transmitted around the curves so as to act, finally, at right angles with its former direction, or parallel with the glacial axis. Hence it follows that the lateral displacing power of the branches on the glacial trunk is greatest at or shortly below the line of their impact upon it, diminishing as the angle of contact, in their passage around the curve, becomes more acute, and becoming practically nil, when they have fully aligned themselves with the glacial axis and become constituent columns of the main trunk.

An interesting circumstance connected with the pressure of the branches, especially of those above the Haigatum which have no opposing branches on the south side, is, that, when an equilibrium has been established by the yielding of the main stream, the compression and folding of the ice, and the pushing up and faulting of its upper layers into irregular projections, and the branch has turned into and occupied the space from which it has displaced the main glacier, the compound glacier thus formed moves downward, until joined by the next lower branch, without exercising any perceptible return lateral pressure toward the side from which the branch entered. This is seen in the fact that,

* *Vide* the *Geographical Journal*, January, 1908, p. 17, illustration.

after the branches have turned downward in the direction of the glacial axis, their free edges, though broken and greatly serrated, rising perpendicularly high above their beds run in straight lines at considerable distances from the former lateral moraines or from adjoining mountain-walls to the junction of the next lower branch. The same was observed to as marked a degree on the Biafo.

Besides the absence of typical median moraines in the hillock-area, where moraine-material is most largely found, such moraines are rather feebly marked over the remainder of the glacier. A few small ones extend out from the south ice-wall just above the entrance of the Haigatum and from the junctions of the Kanibasar and Last Moraine glaciers, but otherwise the remarkable, highly developed moraine-formation existing on the Chogo Lungma is wanting.

Not so, however, with lateral moraines. On the south bank of the glacier below the Haigatum and along the whole of the north bank as far as Last Moraine branch, gigantic, ancient, primary moraines overgrown with vegetation and dwarf-willows exist. The highest of these are found on the north bank between the Lak glacier and the end of the Hispar, where the ridges of some of them, as measured by Drs. Calciati and Koncza, stand 120 metres (393·6 feet) above the present surface of the ice.

Between these and the glacier more recent secondary moraines, some of them of large size, are seen at various places. On the west bank of the Haigatum, just above its entrance into the Hispar, where we camped, five lateral moraines were found, one below another, the fifth, by no means a small one, being still in the process of formation. The highest recently formed lateral moraine adjoining the ice is situated on the north side of the Hispar, just below the junction of the Lak glacier. Its height was measured at 40 metres (131·2 feet).

The Hispar and its larger branches, and also the Biafo at certain points, are, at present, actively engaged in building lateral moraines. At the edges of these glaciers great, ragged, perpendicular ice-walls rise high above the glacier-bed, their summits as well as their substance heavily loaded with *débris*, which is constantly showered down, often in cart-loads, upon the moraines at their bases. At some points the moraines can be seen to grow day by day, and even hour by hour. As these walls move downward in straight lines, they apparently exert no lateral pressure on their moraines, so that there is no question as to their forming moraines by pushing or ploughing up ground-moraine-material, and I saw no evidence that such was pressed out on their sides by their weight. The moraines appeared to be wholly built up by the deposition of the *débris* borne on the glacial surface, as well as in the crevasses and substance of the ice-walls.

Some fine examples of intraglacial moraines cropped out in places on the glacier-edges, composed of detritus which had fallen into and filled

large crevasses. The capacity of the Hispar as a moraine-builder appeared to be exhausted before its ice reached the extremity of its tongue. In contrast to the large lateral moraines higher up, the terminal moraine-formation was not marked, only a small moraine existing in front of one section of the tongue.

Névé and glacier-ice are composed of strata or bands, which represent the snow-accumulation of successive seasons in the reservoir. At the sources of a glacier these are of considerable thickness, and overlie one another in horizontal or gently curving layers corresponding with the conformation of the terrain on which they rest. In a glacial trunk they are compressed, often into thin ribbons, and their edges may be tilted to any angle with the horizontal. They may also be curled and twisted into serpentine folds.

A great glacier is not the best place to study the relation of banding in the trunk to *névé*-stratification in the reservoir. In the complexity of currents, the breaking up into ice-falls and seracs, the displacements, the regelation, the conditions of pressure, folding, and torsion, and other accidents to which the ice of a glacier is subjected, the difficulty of tracing the relation of the final structure of a given mass of ice to that of the *névé* in which it originated, after the great distance it may have travelled from its source of origin to the place where it is observed, is obvious. Indeed, it is marvellous that, considering the vicissitudes it has undergone, the ice near the tongue of a 50-kilometre (31-mile) long glacier should retain such perfect stratification as it often exhibits. This subject is more advantageously studied on short uncomplicated glaciers.

On all exposed surfaces of the Hispar ice-falls, as on similar surfaces elsewhere, the *névé*-stratification was well marked, the strata being horizontal or somewhat curved. So on exposed ice-surfaces at all points of the glacier, even to the extremity of the tongue, stratification was visible; but the strata ran in every direction according to the conditions to which the ice had been subjected on its downward journey. Perpendicular strata were common. In many instances they were curled and twisted into curious patterns, while in one large ice-ledge projecting from the extremity of the tongue they were as horizontal as could be found in the level *névé*. Over the greater part of the end of the tongue stratification could not be observed owing to the discoloured and detritus-covered condition of the ice.

Not one of the grassy, flower-sprinkled maidans described in connection with the Chogo Lungma and Alchori glaciers was met with on the Hispar.* The mountains rise too abruptly from the glacier to afford any space for these. One such maidan was found at the junction

* *Vide* 'Ice-bound Heights of the Mustagh,' pp. 179, 352, 361; and the *Geographical Journal*, March, 1905, pp. 252, 253.

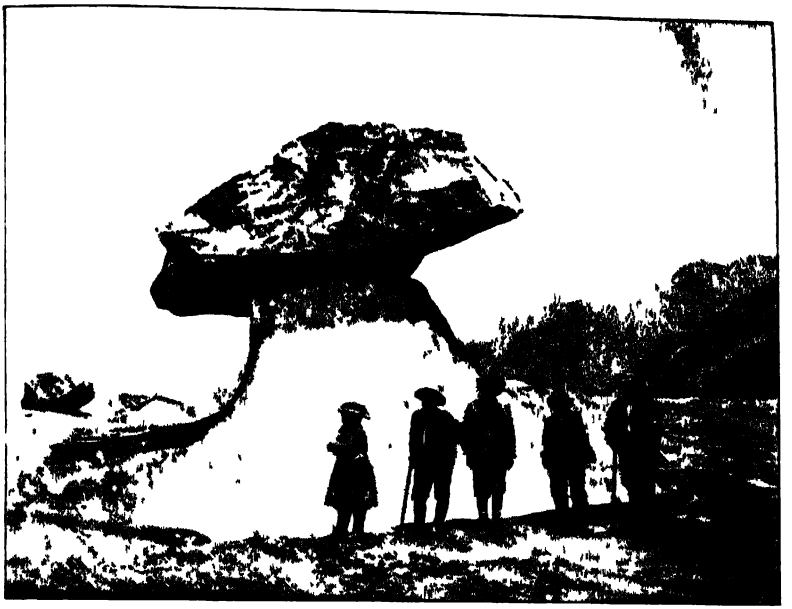


FIG. 4.—A GLACIER-TABLE OF UNUSUAL SIZE MET WITH ON THE LOWEST THIRD OF THE BIAFO GLACIER AT AN ALTITUDE OF ABOUT 3660 METRES (12,000 FEET). THE ROCK-BOULDER WAS 5 METRES (16·4 FEET) LONG, THE ICE-PEDESTAL 3·8 METRES (12·46 FEET) HIGH, AND THE HEIGHT OF THE WHOLE 5·5 METRES (18 FEET). A TABLE WITH MUCH LOWER PEDESTAL SEEN IN DISTANCE AT LEFT.



FIG. 5.—MUD-COVERED NIEVES PENITENTES, THICK DÉBRIS, VARIETY VI., IN CENTRE OF BIAFO GLACIER; COATING THICKEST AT APICES. PYRAMIDS ARRANGED IN TWO LINES. LARGEST 70 CENTIMETRES HIGH. HIGH MEDIAN MORAINE SHORT DISTANCE BEHIND THEM.



FIG. 6. —FOUR OF THE DÉBRIS-COVERED HILLOCKS OF THE LARGER VARIETY STANDING IN A LINE IN THE CENTRE OF THE HISPAR GLACIER AT A DISTANCE OF 29 KM. (18 MILES) ABOVE THE EXTREMITY OF ITS TONGUE. THE HEIGHT OF HILLOCKS LIKE THESE VARIED FROM 15 TO 85 METRES (48·9 TO 278·8 FEET). THE ONES HERE SHOWN ARE AMONG THE LARGEST.

of a branch of the Jutmaru with that glacier, and utilized for a camp. This was of alluvial formation, and had, in the not distant past, been the bed of a border-lake, which had mostly silted up through the deposit of mud poured into it by the streams from the glacier above.

Nieves penitentes were met with, widely distributed, on the Hispar and its branches, on the mountain-slopes enclosing them, and on the Biafo and Skoro glaciers, occurring under a variety of conditions. Careful observation of the material presented, many times repeated, afforded confirmatory evidence of the truth of the views relative to the development of this formation expressed by me before this Society in November, 1907,* and also added new facts regarding it, which throw definite light on this hitherto obscure and little-understood question, in regard to which opinions have differed so materially.

The *nieves penitentes* studied by myself in the Nun Kun in 1906, though scattered over a wide area, appeared to be everywhere of the same kind, and due to the action of one and the same set of causes. The diversity of opinion, however, regarding the mode of development of *nieves penitentes* expressed by various observers, many of whom are men trained in glaciological science, induced me at that time to suspect that more than one set of conditions were concerned in the production of this phenomenon, and that different observers had met with *penitentes* that were determined by different causes, the formation of which they endeavoured to explain upon a common principle, upon which they, naturally, were unable to agree. This view has since been borne out by the various forms of *nieves penitentes* met with in the Hispar region in 1908.

Among the variety of views that have been advanced, observers have practically agreed that one factor essential to the production of *penitentes*, and according to some the only one, is the unequal melting of *névé* under the application of heat in some form, principally that of the sun. Having become convinced by my observations in the Nun Kun, that the action of heat is simply to melt the softer and less resisting faster than the denser and more resisting parts, this action being identical in all cases; and that, for the development of *nieves penitentes* under the application of heat, an antecedent or concomitant differentiation of *névé* or ice into alternate areas or centres of unequal density is also necessary, with the profusion and variety of *penitentes* spread before my eyes in the Hispar region, I endeavoured to solve the problem by directing my attention to the study of the circumstances that might produce such differentiation, with the result that I was able to recognize eight distinct varieties of *nieves penitentes*, the first including three sub-varieties, classified according to observed antecedent causes other than

* *Vide* the *Geographical Journal*, January, 1908, pp. 17–22; also the *Alpine Journal*, May, 1908, pp. 139–148.

melting. This being, so far as I know, the first attempt at classification of *penitentes* that has been made, and based only on what was actually seen, it is quite possible that further observation may disclose additional varieties.

The varieties observed were (I.) The avalanche variety with three subdivisions. (*a*) It was found that in the case of avalanches composed originally of hardened *névé* falling from heights above upon sloping surfaces, over which they travelled for considerable distances, the coarser constituents or blocks showed a tendency to arrange themselves in lines, while the more finely divided and pulverized portions took the form of ridges, both lines and ridges being parallel to one another, with a direction coincident with the incline of the slope and the course of the avalanche. These ridges contained at short intervals centres denser than the rest of their substance, formed between pressure of moving snow behind and resistance of that in front. The action of sun and heat on these avalanche-beds, thus differentiated, had developed *penitente*-pinnacles of various forms and sizes by shaping the *névé*-blocks and melting away the softer portions of the ridges.

(*b*) Where snow-avalanches without a primary, perpendicular drop had slid down over *névé*-slopes, parallel ridges containing centres of denser *névé* were formed, which centres under heat developed into *penitente*-pinnacles of pyramidal type and moderate size, both ridges and pyramids orienting with the slopes and courses of the avalanches.

(*c*) Where new, soft snow at high altitudes of upwards of 5800 metres (19,000 feet) had slid down very steep slopes, and lodged without travelling forward after striking, *nieve*-pinnacles with serrated, feathery apices were developed by melting. These stood in rows largely transverse or diagonal to the direction of fall of the avalanches, though often coincident with it. Although their material was softer than is usual with other *nieve*-forms, denser centres constituting the bodies of the pinnacles were demonstrable. The nature of the avalanche itself thus seems to condition the type of *penitentes* developed on its bed.

II. Subsidence variety. On beds of old, consolidated *névé* covering sloping surfaces not sufficiently steep for production of avalanches, subsidence of their component snow gave rise to straight-edged, longitudinal ridges with denser foci, which had developed into pyramidal *nieve* of medium size, both pyramids and ridges orienting with the inclines of the slopes.

III. Wind-conditioned *penitentes*. Extensive *névé*-surfaces with gentle inclines, both on glaciers and mountains, were covered with parallel ridges running in every direction according to the incline of the slopes, with which their course always coincided. The tops of these ridges bore *penitente*-pyramids of medium size denser in structure than the *névé* between them. These ridges and pyramids, like those on the Shafat glacier, occupied surfaces swept by wind and not exposed to

avalanches. The *névé* composing them was not so old or dense as that of the subsidence-variety, and the ridges were more wavy in outline.

The next four varieties, each presenting distinctive features of its own, depend for their formation on the deposition of detritus of various kinds on a glacier, the detritus, according to its nature, causing the ice beneath it to melt by absorbing and transmitting the sun's heat, or protecting the ice beneath it from the action of heat while the glacial surface around melts away, thus giving rise to *nieves penitentes*.

IV. Thin detritus variety. Over large areas of the Hispar and Jutmaru glaciers *penitentes* were met with varying from a few centimetres to 2 metres (6·5 feet) in height, the intervals between which were occupied by oblong pools with perpendicular walls often a metre or more in depth, the bottoms of which were covered with thin layers of finely divided earthy material, sand, gravel, or thin pieces of shale. These pools were arranged with great regularity, their long axes orienting mostly east and west, as did those of the *penitentes* between them.

Here the *penitentes* owed their existence to an antecedent deposit of detritus, probably mostly through æolian agency, in parallel wavelets upon smooth surfaces of the glaciers. These wavelets, absorbing and transmitting the sun's heat in virtue of their dark colour, caused the rapid melting of the ice beneath them, thus forming the pools at the bottom of which they lay. The pinnacles of ice left standing white and clean between them were moulded by heat into *nieves penitentes* of typical shape.

V. Glacier-table-variety. This was seen in abundance on the Hispar and branches, and on the Biafo and Skoro glaciers, below the limit of *névé* along the courses of moraines, where multitudes of boulders and glacier-tables covered the surface. Glacier-tables are formed by the melting of a glacial surface around the resting-places of large boulders, leaving the latter supported on pedestals composed of ice, which, protected from the sun's rays by the boulders, has remained unmelted. As the upper extremities of the pedestals become bevelled by melting, the boulders no longer sit level upon them but begin to tilt, and, as the bevelling becomes more accentuated, they finally slide off on to the glacier, leaving the pedestals standing as ice-shafts 1 to over 2 metres (6·5 feet) high, which are further sharpened off into *nieve*-pinnacles by heat. In some cases the shaft is developed into a fully formed pyramid before the top slides off. In other cases it is sharpened off after this event. These *penitentes* were found single, in groups, and in lines, in the two latter cases being developed from pedestals of several glacier-tables standing together, or from several hardened columns formed beneath very large boulders. Their orientation was determined by the shape and character of the boulders to which they owed their existence.

VI. Thick detritus-variety. This was seen mostly on ice below the

névé-line also along the courses of moraines, orienting in every direction irrespective of inclines. The pinnacles were met with, a few in a place or in large numbers, arranged in great part in lines, covering plain ice-surfaces, slants, crests, depressions, and even the exterior of séracs. They were invariably coated with mud, sand, or gravel, most thickly over their apices and the ridges running out from them. They consisted of dense, crystalline ice destitute of air-bubbles, and much harder than the melting aërated ice around. They owed their origin to the deposition on the glacier of patches of mud, sand, or gravel, which, like the boulders of the glacier-table variety, protected the ice beneath them from the heat of sun and air, that melted away the surrounding ice, leaving them as *penitente*-pinnacles, always of pyramidal type, and often 2 to 3 metres (6·5 to 9·75 feet) high, one of 10 metres (32·8 feet) being found.

VII. Lacustrine or composite variety. This was found on old beds of consolidated *névé* adjoining glacier-lakes, in the mud-laden waters of which they had been submerged. The pinnacles were triangular and quadrilateral pyramids, 30 to 40 centimetres (12 to 16 inches) high. They were arranged in regular rows, were connected with one another by ridges, and oriented with the slopes they stood on. They were coated with mud, most heavily over apices and ridges. In this case the differentiation into pyramids and depressions probably occurred through the agency of wind or subsidence and sun antecedently to their immersion in the lake; but the action of water may have accentuated the process, and it deposited the mud in consequence of which their further development, after subsidence of the water, would proceed on the lines of that of variety VI. Similar *nieve* was seen on beds of hardened *névé*, which had been submerged by muddy torrents resulting from the bursting of glacier-dams.

VIII. Sérac variety. Many tall, slender séracs were seen on ice-falls modelled by heat into cones and pyramids of giant size displaying all the features of ordinary *nieves penitentes*, even to hoods, and evidently fashioned in the same manner. Also on their surfaces small projections and irregularities were sculptured into *penitentes* of usual size and shapes.

The extended observations, which have made the above classification possible, lead me to the conclusion that *nieves penitentes* are developed by the action of heat, from whatever source derived, upon *névé* in which ridges containing centres or foci of hardened snow, and sometimes such centres independent of ridges, have been formed by avalanches, subsidence or wind, the size and shape of the centres determining the size and shape of the resulting pinnacles; and also upon *névé*, but more notably upon ice on which detritus has been deposited under circumstances described, or which has been disrupted into comparatively slender fragments or séracs. In all cases heat melts away the softer and less protected portions more rapidly than the harder and better protected ones, leaving the latter standing as *nieves penitentes*. The sculpturing

process may, in rare instances, be assisted by the action of water as in variety VII.

NOTE.—For a detailed consideration of this subject, which is only indicated in a very condensed form here, *vide* a paper entitled "A study of *Nieves Penitentes* in Himalaya," Paper No. 2, by William Hunter Workman, M.A., M.D., in the *Zeitschrift für Gletscherkunde*, Band III., Heft. IV., May, 1909. Also for a somewhat less detailed description *vide* "Peaks and Glaciers of Nun Kun," by Fanny Bullock Workman and William Hunter Workman, pp. 163–199.

Sir MARTIN CONWAY: Before making one or two remarks on this interesting paper, I should like to return my very cordial thanks to Dr. and Mrs. Workman for the delightful pleasure they have enabled me to enjoy to-night, in revisiting, by aid of their beautiful photographs, this perfectly glorious region, second to none of the mountain regions of the world, for beauty and interest. Mrs. Bullock Workman referred to the nomenclature of the glaciers of the Hispar Nala. Of course, travelling very rapidly through a country, as a first pioneer must do, it is not possible to do more than collect such names as the natives present give. My experience is that it is very difficult indeed to place much reliance upon those names. Certainly the glacier which was called Kanibasar on my map appears to be next to the one called Kanibasar on Dr. and Mrs. Workman's map. I have no doubt they may have obtained a more correct location for the name; but when I was there, only a few of the oldest coolies had been up the Hispar glacier before, and none of them were quite sure of where some names should be located. Names float about in those very remote places, and, as a matter of fact, they may not become firmly fixed until the map-maker comes and fastens them down. I found a similar uncertainty as to the names of some of the tributaries of the Baltoro glacier.

The second point I would refer to, is the question of the Cornice glacier. Dr. and Mrs. Workman have proved clearly, by their photographs, that the place where I put the exit of the Cornice glacier is barred across by a rock wall. When I was on the spot, that rock wall was hidden under clouds. By some peculiar divination, for which I give myself great credit, I must have discovered that there was a glacier behind that wall, for my only reason for marking the glacier on the spot where I did, and where the Cornice glacier is actually situated, was because on that foggy day I thought I saw it. Now it appears I did not, and therefore, frankly, I know nothing at all about the Cornice glacier. I wish, however, to call attention to the very remarkable fact, which Dr. and Mrs. Workman have put on record. They have looked down into the Cornice glacier basin from various points. This glacier basin lies at a level approximately 17,000 or 16,500 feet above sea-level, and the wall on the side where they showed us the photographs cannot be above 1000 feet above glacier-level. So that you have a glacial basin entirely surrounded by mountains, at one place only 1000 feet high, and this glacier basin has no exit whatsoever. There it is, and there it has been, I suppose, for thousands of years; and into that basin there must have been pouring snow all that time, and yet it is not full up: 1000 feet of snow would fill it, and to make a thickness of 1000 feet of snow would certainly not take above two hundred years of snowfall, and it has had a great deal longer than that. Now if there is no exit anywhere, how does the snow get away? Why has it not filled up and overflowed the low gap that opens to the Biafo glacier? My conclusion is that there must be an exit somewhere; and I think that after Dr. and Mrs. Workman's repeated journeys of exploration, they have got to go back again once more. They have got to climb into this glacier and find its outlet.

Finally, I would refer to Dr. Workman's most interesting remarks and observations

about the surface forms of snow and ice, which he has grouped under a number of different heads. I would only quarrel with him about the name under which he unites them, that of *nieves penitentes*. In my opinion all the variety of forms he has identified and grouped under different headings include no *nieves penitentes* amongst them. It is, perhaps, a mere question of name. You can call them all *nieves penitentes* if you like; only that is not what *nieves penitentes* really are. *Nieves penitentes* is a name given in the southern part of the Andes to a particular snow formation, not just the snow pinnacles, but to a particular kind of snow pinnacle. It is a snow pinnacle of a quite definite kind. It is different in appearance from anything that was shown in those beautiful slides of Dr. Workman's. They all show you phenomena connected with the surface forms of snow—how it may be moulded into pinnacle shapes and ridges of several kinds, and produced by different processes; but the *nieves penitentes* of South America are different from all of them. We have seen actual *nieves penitentes* on that screen on many occasions. The characteristic of the *nieves penitentes* is that they are moulded out of a bed of snow by the peculiar action of the sun. They are all of them roughly pyramidal in form, of an oval-pyramid form, the major axis of the oval running approximately east and west, and all the pyramids dip towards the north in the southern hemisphere—towards the sun. Then those of one group are almost always of approximately the same height, and they look (and that is why they are so called) like a crowd of *penitentes* clad in white sheets on the hill-side, and the Spaniards in South America call them *nieves penitentes*. As the season advances, the hollows enlarge and deepen between them. The sun looks down into the hollows; the reflection concentrates heat at the bottom, and the hollows are melted deeper and deeper right down to the ground. The pinnacles of snow are finally left standing on the ground, each one separate from the other, very often in hundreds. Those are what in South America they call *nieves penitentes*. You may take the name, and by analogy apply it to various pinnacular forms of snow, only you would not be understood in South America if you did. I have never seen, either actually or in photographs, anything like them in the Himalayas, or the Alps, or in Spitsbergen, or in any other part of the world, and I should be very glad to know that, after Dr. and Mrs. Workman next year have made an expedition to Cornice glacier, they will make another expedition to the Andes of Chile and the Argentine, where they will find these *nieves penitentes*, and where Dr. Workman might continue to enlarge his observations on the various forms of sculptured snow surfaces, which he has already so carefully studied. I am not now criticizing his classification; I am merely suggesting that it would be better to keep the term *nieves penitentes* for the particular form for which the name was invented. I should like once more to thank Dr. and Mrs. Workman for their delightful paper, to congratulate them on the continued success of their great achievements, and to express the hope that we have not heard them here for the last time.

The PRESIDENT (after the paper): Any one travelling in such a region as this must often be tempted merely to focus their interest on feats of mountaineering. I believe I am right in saying that the feats accomplished by Mrs. Bullock Workman are more remarkable in the way of mountaineering than those which have been performed ever before by any one of her sex. Whether I ought to make that limitation or not, I am rather doubtful, but at all events, with that limitation, it will not be denied. But in spite of all the difficulties, our travellers have throughout the whole of their journeys kept their eyes steadily fixed on geographical work, and have therefore brought back with them ample stores of new information, both with regard to the topography of the districts visited, and concerning those interesting snow columns, whether they be called *nieves penitentes* or not. Therefore, I am sure

in the name of every one here present, we not only thank them for their extremely interesting papers, but wish them good luck the next time they go to their regions —good luck in conquering new peaks and traversing new icy fastnesses.

Dr. WORKMAN: I am greatly surprised at the assertion of Sir Martin Conway, that the formations I have shown on the screen to-night are not *nieves penitentes* at all. If they are not *nieves penitentes*, I would ask him, What are they? His conception of *nieves penitentes*, as he gives it, is too restricted to be up to date. In the light of the careful observations made during the last fifteen years in the Andes, in the Sierra of North America, in equatorial Africa, in Himalaya, and even in Iceland, it cannot be said to-day that this formation occurs only in the Andes, or only on one variety of basis, or that the pinnacles have any exclusive shape or size, or that their long axis or the lines in which they may stand orient only east and west.

Among others who have studied them elsewhere than in the Andes, Prof. Hans Meyer, than whom there is no higher authority on *nieves penitentes*, who has seen them in great quantity in various localities in the Andes, and who, therefore, according to Sir Martin Conway's standard, if any one, should be able to recognise them, asserts that he found typical *nieves penitentes* on Mount Kilimanjaro and in the crater of Kibo in Central Africa.

Sir Martin's argument to support his contention that an enclosed glacier cannot exist because the basin in which it lies would fill up with snow is not convincing. It is true that Nature furnishes a new supply of snow to feed a glacier each winter, but it is also true that, during the succeeding summer, it removes a large amount of such snow by melting and evaporation, even above the snow-line, and below it the waste exceeds the supply, till the glacier finally dies out.

There is no reason why an enclosed glacier should not die out within its own basin without having an outlet on another glacier, provided its basin falls to an altitude sufficiently below the snow-line. The question of the life of a glacier is simply one of supply as compared with waste, irrespective of its connection with any other glacier or of its basin with any other basin.

Cornice glacier in question, from its origin on the west Biafo wall, occupies the bottom of a deep narrow valley, or nala, with precipitous sides. Its reservoir is therefore small, and the amount of snow which collects to feed it limited. From its head it descends speedily to a level of 15,000 feet, and then considerably lower than that, *i.e.* to a level much below the snow-line of the region. Further, the valley and glacier run from east to west, and the sun pours its rays into the former upon the latter for many hours during the long summer days with a heat of from 180° to 210° Fahr., the melting effect of which is increased by the confining of the heat by the perpendicular enclosing walls, which exclude all wind. The singeing heat experienced in such valleys is well known to those who have travelled through them in Himalaya during the warm hours of the day. Under these circumstances the wastage from melting and evaporation equals at least the increment from the winter snow-supply, and in fine-weather seasons must exceed it, and is sufficient to keep the glacier, as we saw it, at the very bottom of its nala.

When we looked down from the col at the head of the Hoh Lumba (overhanging Cornice glacier not a great distance below its origin) upon Cornice glacier beneath us in the middle of June, its surface even at that point and at that early season consisted of fully formed glacier-ice, cut up by crevasses, entirely denuded of winter snow and *nieve*, which had already melted away. This was six to eight weeks before the maximum of melting takes place in that region, and, with the sun exerting its destructive effect upon that narrow surface of ice for another eight weeks, it is easy to judge what the chances are of that glacier filling up the chasm 2000 to 3000 feet deep, at the bottom of which it lies.

The noteworthy facts, that this glacier lies at a much lower level than the corresponding portions of other glaciers around it, that it is composed of fully formed ice, while they are deeply covered with snow and *névé*, and that it is enclosed on all sides by high mountain walls, in which the direct observation of those who have been entirely around it has disclosed no opening, as well as the indications afforded by the condition and size of the glacier itself, supply more conclusive evidence that it is enclosed only by and ends only in its own basin, than the disbelief of Sir Martin Conway, who has never seen the glacier nor any of its barriers, except the south Hispar wall, which, according to his own testimony, has no opening at this part.

A NATURALIST'S TRAVELS ON THE CONGO-ZAMBEZI WATERSHED.*

By S. A. NEAVE, M.A., B.Sc. Oxon.

THE following notes are the result of more than four years' wanderings in Northern Rhodesia and the Katanga region of the Congo Free State. Some of the country here discussed has already been dealt with by Mr. L. A. Wallace, the present administrator of North-West Rhodesia, in the *Journal* of this Society for 1907, pp. 369 *sqq.* He has there described the main geographical and geological features of the country very fully. It may, however, be of some interest to supplement his excellent account with some notes on the faunistic features of this part of Africa—more especially as I was fortunate enough to travel some considerable distance through a contiguous area in the Congo Free State, a region which does not come within the scope of Mr. Wallace's paper.

Before dealing with the local conditions, it is necessary to shortly review the general distribution of the fauna of Africa south of the equator. The South African subregion has usually been considered to be bounded to the north by the Zambezi river, on the east, and by the Cunene river on the west, and this is, no doubt, roughly correct. It is, however, of great interest to observe that whilst the tropical species of the equatorial zone (I am here more particularly referring to butterflies and other insects) have spread down the east coast as far as Durban, they do not on the west extend much below the Kwanza river in Angola, a difference of 20° of latitude. This is no doubt mainly due to the high central plateaus on the eastern side of the African continent in this latitude being remote from the sea-coast, whilst on the west, in Angola, the lowlying coast-belt is vastly narrower. On the west side the advance of a tropical fauna to the south is also much checked by the very dry climate which obtains on the coast-belt in southern Angola and to the south of it. This great central plateau is often hundreds of miles wide, and in this latitude its long

---

* Read at the Royal Geographical Society, November 22, 1909. Map, p. 224.

axis runs roughly east and west, so that it would be possible to travel from German East Africa to within 200 miles of the coast in Angola without descending below 4000 feet above sea-level. The Congo-Zambesi watershed forms the backbone of the central portion of this plateau.

To demonstrate that the high land which forms this watershed is an important barrier to the advance of the western tropical fauna is the chief object of this paper.

Before entering into the details of the area under discussion it will, I think, be convenient to subdivide it into three very natural divisions. These are—

(1) The low ground in the Zambesi basin.

(2) The Congo-Zambesi watershed and the high ground on either side of it.

(3) The low ground in the Congo basin.

The first of these divisions, so far as Northern Rhodesia is concerned, is limited to the valley of the Luangwa river and to a small portion of the mid-Zambesi valley. The vast proportion of this area lies below 2500 feet, and only comprises higher ground towards the borders of Nyasaland and Portuguese South-East Africa. The fauna and flora of this lowlying area are quite distinctive compared with that of the rest of Northern Rhodesia. The mammals, birds, and insects found in the Luangwa valley are mainly those which occur in the lower Zambezi valley and much of the south-east coast region of Africa.

There are also present a few species which, though not known to occur south of the Zambezi, have already been recorded from Nyasaland. As an example of these latter may be instanced the pretty little love-bird, *Agapornis lilianæ*, Scl.

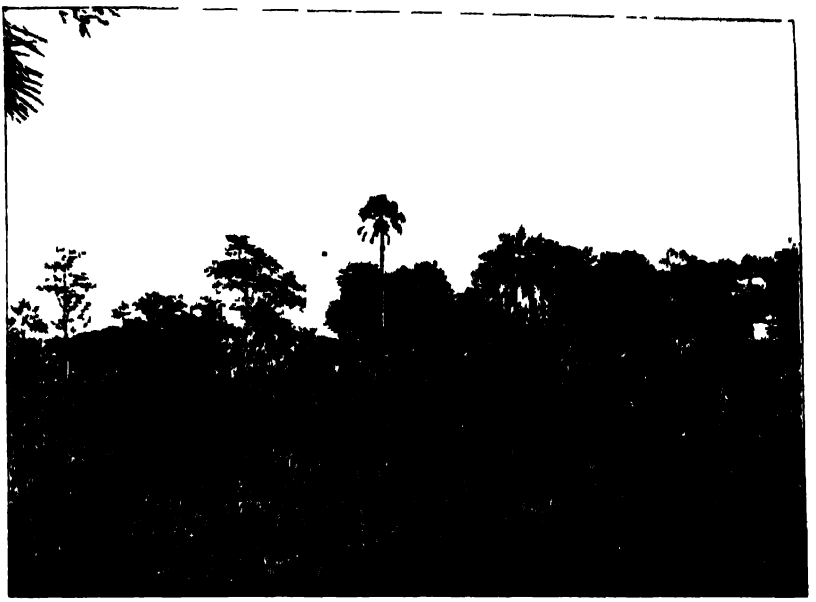
A very large proportion of the Luangwa valley consists of broad alluvial flats through which the river flows. The bed of the river is very wide, the sandy banks often having an edging of phragmitis reed, the white plumes of which are very effective at a distance. A close acquaintance, however, with this plant is not desirable on account of its spear-like blades.

The Luangwa valley exhibits a very different appearance at the different seasons of the year. At the height of the rainy season the river is a wide and turbulent waste of muddy waters, and often overflows its banks. At this time the flat stretches of alluvial soil in the neighbourhood of the river are singularly unpleasant to travel over. On these flats the soil largely consists of a peculiarly tenacious and impermeable clay of a dark grey colour. The huge cracks which form in this clay during the dry season are rapidly filled up by the first heavy rains. When this has once taken place the whole country soon becomes water-logged, and, when once in this condition, even a slight shower will produce standing water everywhere. When making a journey up the Luangwa river in February and March, 1908, I was

much astonished at the extent of the floods. It was an extraordinary sight to see huge stretches of "mopane" forest standing in from 6 inches up to 3 or 4 feet of water. This tree, a species of Copaifera, the "ironwood" tree of Livingstone, is a remarkable one and highly characteristic of this area; in fact, so far as North-Eastern Rhodesia is concerned, it is confined to the basin of the Luangwa river. More particularly in the low ground of the valley large stretches of forest composed almost entirely of this tree are met with. This is an unusual character in the African woodland or forest, which is much more generally composed of a great variety of trees. It is perhaps here well to point out that dense forest formed of large trees as opposed to woodland is distinctly uncommon in any of the areas under discussion, though, as we shall see later, it occurs occasionally in the Congo basin. A very large proportion of the whole country, more especially the hilly areas, is more or less uniformly covered by rather thin woodland, the majority of the trees being of moderate size.

In the "Mopane" forest but little grows beneath the trees and in the clearings among them except short and not very vigorous grasses. This, perhaps, is due to the peculiar conditions of the soil. To grow successfully in a heavy clay which is water-logged in summer and baked as hard as a rock in winter, no doubt requires considerable specialization. The "mopane" trees seem peculiarly adapted to these conditions, but do not as a rule grow to a very large size, nor with very straight trunks. This rather discounts the commercial value of their timber, which is, however, very hard, and said not to be attacked by termites. The living tree is strangely inflammable. The natives take advantage of this peculiar character. In order to fell one of these trees, they insert a burning stick into a crevice in the trunk. The tree will then begin to smoulder, and will fall burnt through the trunk within some twenty-four hours, and then, if left to itself, will lie smouldering on the ground for days. Another tree which is common in the Luangwa valley, and characteristic of the eastern tropical region, is the grotesque baobab. Yet another type of vegetation, often in patches of considerable size, occurs commonly. This is locally called by the natives "lusaka" or "malusaka," and consists of rather dense thickets of shrubs mixed with creepers and occasional trees and thorn scrub. This country is extremely difficult to travel through, and when very extensive even natives are easily lost in it.

In the height of the dry season the Luangwa valley has an appearance vastly different from that in the wet. When the bush-fires, which generally occur about July, have destroyed the grass and smaller undergrowth, the trees, except for a few species of ficus and other evergreens on the river and stream banks, all lose their leaf, giving a very barren appearance to the country. At this time the Luangwa river itself, especially on the upper part of its course, becomes little



LUANGWA VALLEY



NATIVE CHIEFS AND THEIR WIVES BRINGING FLOUR.



LOFU RIVER.



DIKULWE RIVER.

more than a shallow and winding stream, dotted and margined with sandbanks.

It is now that the river becomes a feast for the eye of the naturalist and sportsman, presenting as it does a most wonderfully varied scene of animal life. The sandbanks are covered with storks, cranes, plovers, and wading birds of all sorts, the comparatively cryptic colours of many of them being varied with the snowy plumage of the egrets, which, in company with many others of the heron tribe, frequent the marshy parts of the banks.

Now and then a small flock of the African skimmer (*Rhynchops*), with their swift but zigzag flight, pass up or down the stream. With luck one may see in the distance four or five of the beautiful crested cranes (*Balearica*) performing their quaintly solemn dancing, or the handsome but wary saddle-billed stork (*Ephippiorhynchus senegalensis*) may be observed in pairs, stalking along the water's edge or on the grassy flats. This river seems specially suitable to the crocodile, large numbers of which may be seen basking on the sandbanks during the heat of the day.

Regularly morning and evening, as well as at night, large herds of game come down at this season to drink. At this season, too, the resident inhabitants of the river-banks, such as water-buck, puku, bush-buck, impala, zebra, etc., have been reinforced by other species which spend their wet season on higher grounds. Amongst these are Lichtenstein's hartebeeste, kudu, roan antelope, and rhinoceros.

When the rains break, which they usually do very suddenly, the whole country changes as if touched with the wand of a magician. In two or three days everything bursts into leaf, and the ground becomes covered with a carpet of dazzling green velvet, contrasting with the grey-green foliage of the "mopane" trees. These "mopane" flats, as they are often called, have a very characteristic fauna. The South African giraffe, occurring nowhere else in this part of Africa, still exists in small numbers in the central part of the valley. The beautiful and graceful impala antelope, which is very rare on the plateau to the west, occurs in considerable numbers. The blue wildebeeste, which does not occur elsewhere in North-east Rhodesia, is found thinly, though widely distributed over the upper part of the valley. In common with the water-buck this antelope does not follow the example of the other large species, such as the roan antelope, in making for the foothills in the rainy season, but continues to inhabit the more or less flooded country. It should here be noticed that the common water-buck (*Cobus ellipsiprymnus*), which is so abundant in this low country, does not occur on the high plateaus to the west. Of the smaller mammals the most characteristic is perhaps the little squirrel (*Funisciurus cepapi*), which is extremely abundant here, though uncommon elsewhere on higher ground.

Amongst the characteristic birds, especially of the mopane flats, may be mentioned the red-billed hornbill (*Lophoceros erythrorhynchus*), which the natives call "kopi kopi" in imitation of its cry. Another peculiar bird is the stripe-chested weaver (*Ploceipasser pectoralis*), which I did not meet with in any other part of the country. This bird builds extremely untidy nests of dried grasses, placing them, as a rule, at the extreme end of the boughs of a thorny species of mimosa. It is a very noisy bird even for a weaver, especially during the nesting season. Another bird, which is here, apparently, at the extreme northern limit of its range, is the South African sandgrouse (*Pterocles bicinctus*). This bird, which is generally found near water, so much resembles the ground, and lies so close, that in spite of the absence of cover, one often all but treads on it before it rises. Another game-bird, which is here on about the western limit of its range, is the common East African guinea-fowl (*Numida mitrata*). As we shall see later, this bird is replaced on the high plateau by another species.

Innumerable other instances might be given of animals which occur commonly in the Luangwa valley, but which are either non-existent or very rare on the high plateau. It will here suffice to say that the animals of all classes in the Luangwa valley are either identical with, or very closely allied to, those of the eastern and south-eastern coast regions within the tropic.

We now come to the second subdivision of our area, namely, the high plateau country, the backbone of which forms the watershed between the basins of the Congo and Zambezi rivers. In the north-east corner of Northern Rhodesia the watershed lies very near to the edge of the plateau. This edge is formed by the great Mchinga escarpment which is the western boundary of the Luangwa valley. About lat. 13° S. the watershed turns nearly due west, and becomes the boundary between North-Western Rhodesia and the Congo Free State. South of this point the escarpment is broken up by the lowlying valley of the Lukashashi river, which resembles that of the Luangwa in character and fauna. Ultimately this wall-like escarpment, turning westward, gradually falls away toward the upper Zambezi valley. The whole of North-Eastern Rhodesia, therefore, west of the Mchinga escarpment is included in this high plateau area, with the exception of the low ground in the valleys of the Luapula, Kalungwisi, and Lofu rivers, and the shores of Lakes Mweru and Tanganyika. These we shall deal with presently.

This area also includes a wide strip along the watershed, forming the boundary between the northern portion of the North-Western Rhodesia and the southern portion of the Congo Free State.

This high plateau country has a great general similarity throughout as regards its flora and fauna. For the most part flat, it is extensively covered with woodland, but the open grassy plains are much larger and

more numerous than on the lower ground just discussed. The protection of this woodland from the natives is a problem which is not yet successfully solved by the administration. Almost throughout this area the natives avoid, for purpose of cultivation, the lowlying grass-covered areas on the banks of streams and vleys, the small amount of drainage necessary, being apparently the factor which deters them. They are, therefore, confined to cultivating their crops in the higher and dryer, though less fertile ground in the woodland.

To do this they cut down the timber over a large area, and collect the cut branches, etc., into a few circular patches, having chosen, if possible, for this purpose the neighbourhood of a large termite mound. They set fire to these, and the resulting ash forms the manure for one or at most two years' crop. The consequence of this is that, though but little ground is actually cultivated, enormous areas of timber are destroyed. In fact, in the more populous parts it is difficult to find woodland which has not suffered in this manner at some time or other. It is true that in the northern part of the country amongst the Awemba and neighbouring tribes, the trees are seldom killed outright. In this part it is the custom among the natives to climb up the trees and lop all the branches off. Further south, among the southern Babisa, Ba-lala, Ba-lamba, and some of the Congo tribes, the trees are usually cut down some 3 or 4 feet from the ground. Yet another evil arises from this method of cultivation, because the bush is not fired by the natives until very late in the year. This is due to the inherent laziness of the native who defers the preparation of his garden till the last moment. The result of this is that the native who has his garden ready has to wait to fire the bush until the laggards also have their gardens in the same state. This late burning of the bush is a very serious evil. Among the Awemba and other tribes to the north it frequently does not take place until the trees have assumed the foliage of the following year. It should be pointed out that in the comparatively cool and temperate climate of the high plateau, the onset of spring commences much earlier, and is a much more gradual phenomenon than in the lower ground, beginning as it does long before the onset of the rains. It is at this season that the most wonderful tints are seen in the woodland. Much of the young foliage at this time exhibits many varied and beautiful shades of red and pink.

The problem of this forest destruction becomes annually more and more serious, but is not at all an easy one to solve. Like all primitive races, the Central African native is an extremely conservative individual. His present method of cultivation entails a considerable amount of labour, and his crops, which consist chiefly of a dwarf species of millet, are far more scanty and at least as uncertain as those of sorghum and maize grown by the tribes inhabiting the lower ground. It has, further, already been shown that, where tried, maize, etc., has been grown quite

successfully in this upland country. In spite of all this, the native of the high plateau does not take at all kindly to any form of cultivation other than that carried on by his forefathers. This is especially so amongst the Awemba, the most dominant and intelligent of the plateau races in North-Eastern Rhodesia. This opposition seems to be largely fostered by the women, who have considerable influence amongst this tribe. This hostility on the part of the women to a change in the method of agriculture is not unnatural. It is due to the fact that the method of cultivation by cutting the timber is very largely a man's work, whereas the reverse is the case in cultivation with the hoe. It has been necessary to refer at some length to this question of timber cutting, since it has a very marked influence upon the general appearance of very wide areas. Once they have been cut, the tree-stumps or pollarded trunks have to undergo a very keen struggle to survive the annual bush fires. In consequence of all this, a good deal of country is covered with ragged scrub instead of woodland, formed of moderate-sized trees.

Where this high plateau country is undulating, the valleys of even the smallest streams are sharply outlined by being bordered with sloping grassy plains of varying width. When a certain elevation from the stream is reached, the grass land is margined by a very definite line of timber. These long narrow plains follow the courses of the streams for great distances, and they vary from 50 yards to a mile wide, according to the degree of slope. They are usually covered with wiry and not very long grass, the surface being very tufted and uneven. In cases where the slope is a fairly steep one, the edges of these grassy valleys are often covered with large quantities of bracken—an old friend, which seems somewhat out of place in Central Africa. This type of country is a particularly favourite one for the noble sable antelope. It is a very fine sight to see a coal-black bull, morning and evening, marshalling a herd of his bright bay-coloured wives on these small plains.

Another characteristic feature is the "msitu," to use a local term. These are patches of dense forest seldom more than a few acres in extent, sometimes much less. They are commonly on the source or banks of a stream. Formed of immensely tall trees, much crowded together and with a tangle of creepers around their trunks, they often stand out in patches of open marshy ground in the most strange way. In the Congo basin, especially towards the west, near the Angolan frontier, these "msitu" become much more extensive, and continuously follow the course of small streams for many miles. These patches of tropical forest frequently contain trees of great girth, much valued by the natives for canoes. The fauna of these somewhat isolated patches is peculiar compared to that of the surrounding country. They are not much frequented by the larger mammals, being chiefly the haunt of leopards, monkeys, and the little bluebuck (*Cephalophus nyassæ*).

The birds and insects are, however, highly characteristic. Among the birds the ground thrushes (*Cossypha, spp.*), and various woodland species of Bulbul are well represented. An interesting bird which is an annual visitor to these forest patches, is a gorgeous glossy starling (*Lamprocolius glaucovirens*). This West African bird visits these spots on the high plateau from September to November, possibly longer. It apparently does so to breed, as I have found young birds which could just fly, the first week in November. They also seem to select the time when the fruit is ripe for their visit. These birds have the most bewilderingly ventriloquial voices, and an extraordinary range of notes.

Among the more remarkable insect inhabitants of these spots are the formidable driver ants (Dorylus). These wonderful insects occur everywhere, but are particularly common in the high plateau country and in the neighbourhood of water. They are frequently to be seen marching in vast armies, several individuals abreast. Many of these are carrying food supplies, and are guarded on the flanks by innumerable armed sentries. Woe betide the man who is so unlucky as to tread amongst them. He is immediately covered with a host of bloodthirsty enemies, who bury their mandibles in his flesh, producing the sensation of innumerable red-hot needles. The insects not infrequently invade camps and native villages, and can then only be turned from their objective by a line of red-hot ashes. Except for the inconvenience of being turned out of their huts, these visits are not objected to by the natives. Every living thing has to depart hurriedly or die on these occasions, with the result that much of the vermin disappears—for a time, at least. Another insect, nearly as warlike as the driver ant, is a species of Ponera, a large black ant which has a powerful and painful sting. This insect is particularly addicted to walking on native paths, and usually does so, about four or five abreast, flanked by a few skirmishers. When alarmed, the whole community has the singular power of being able to produce a peculiar rustling noise. It wages perpetual war upon the termites, and may often be seen returning from a successful foray. On these occasions the majority of the army is laden with the bodies of their victims.

It is impossible, in describing any part of tropical Africa, to avoid some mention of the termites. The different species of these insects build very varied and remarkable mounds. Some of them are of enormous size, and have a marked influence upon the landscape. They are sometimes as much as 20 feet high, and are frequently placed at somewhat regular intervals about 30 or 40 yards apart. On the plains, on the other hand, the commonest species makes a much smaller mound, and it is a striking sight to see a grassy plain apparently studded with innumerable grey objects looking very much like stalagmites. In some parts of the plateau in the Congo basin country there

is a species which makes a small mushroom-shaped mound, a new top being apparently added each wet season. The result of this is that an old nest looks like a pile of hats or flat, somewhat circular pudding-dishes.

One of the most remarkable spots in this high plateau country is a large pool in the limestone in the valley of the upper Kafue river, North-Western Rhodesia, and not far from the old administration post of Kapopo. I have already given some account of this spot in a short abstract of my first journey,* but perhaps, having paid it a second visit, it will not be out of place to give a further account of it.

This wonderful pool lies in flat country, and one comes on it quite suddenly, its banks being concealed by some dense forest. Indeed, without foreknowledge of the existence of this pool, the traveller might pass within 50 yards of it and not realize its presence.

The pool is roughly square and somewhat over 100 yards across. The walls are of limestone and so precipitous that it is only possible to get down to the waters at one spot. On both occasions when I visited this pool, in October, 1905, and January, 1907, *i.e.* just before and just after the beginning of the rains, I found the water-level to be approximately the same. This was some 16 feet below the top of the walls, which closely represents the level of the surrounding country. Judging, however, from the flood-marks on the walls, there would appear to be a considerable rise in this water-level during the height of the rains. This would seem to point to some underground connection with the local water system. The water itself is extremely still, clear, and intensely cold. There were little or no signs of vegetable life, but a number of fish were visible, some of them of fair size. So pellucid was the water that it was easy to see them quite clearly at a considerable depth. I made an attempt to sound this pool, and though I used 300 feet of rope I could not find bottom. This was the case even when it was done only at sufficient distance from the side to ensure the large stone, with which the line was weighted, not lodging on any ledge on the walls.

There is a small native village near this pool, and the inhabitants have a superstitious dread of it. The local native refuses to drink the water or use it for any purpose whatever. This attitude on the part of the natives is perhaps not entirely unreasonable. To sit beside this still pellucid pool of unknown depth, surrounded by precipitous walls, situated as it is in the heart of the tropical forest, would, I think, induce a feeling of awe in the breast of even the most civilized man.

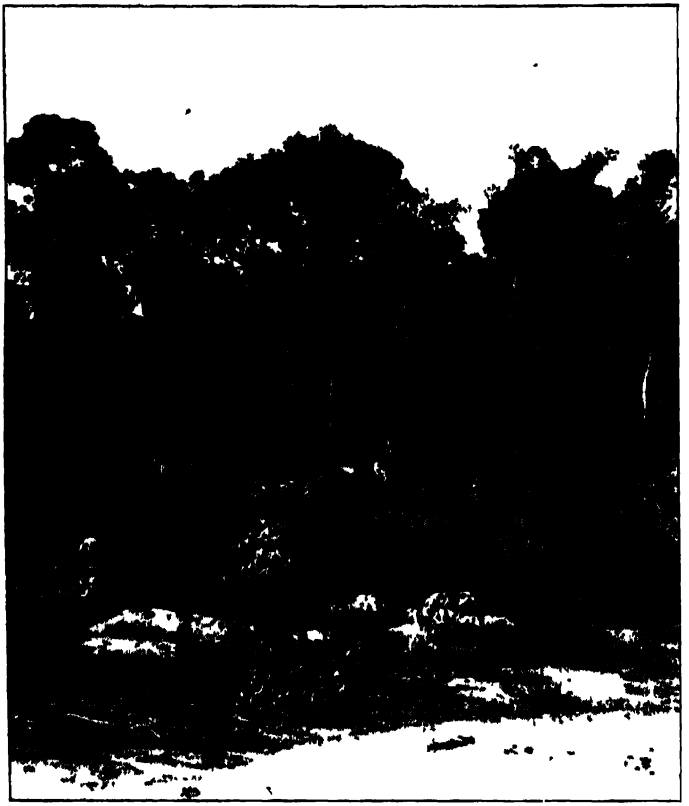
Another striking feature of the high plateau areas are the huge stretches of shallow water or pans which occur upon it. Of these the most important is, of course, Lake Bangweulu. Moir's lake, near Serenje, and Lake Young, near the source of the Mansya river, a



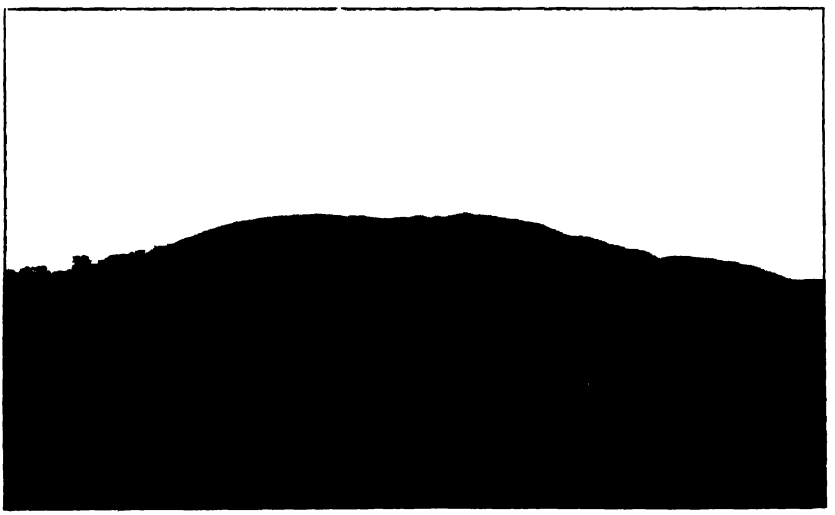
KATWILUME FALLS, KALUNGWISI RIVER



POOL NEAR KAPOPO



THE "MSIDI."



COPPER MINE NEAR KAMBOVE.

tributary of the Chambezi, are small editions of it. As regards Lake Bangweulu, comparatively little of it is represented by permanent open water, and its shores, particularly to the east, are very ill defined. So flat is the country in this direction that many of the rivers are little more than swamps.

The shores and swamps of Lake Bangweulu, more especially during the dry season, exhibit a most amazing spectacle of bird-life. Besides eight or nine species of duck and geese, I obtained or noted on this lake innumerable herons, egrets, coots, ibises, kingfishers, etc. There were also present a small species of gull and huge flocks of the strange "open bill" (*Anastomus lamelligerus*), and many other birds. Amongst the water-plants were quantities of the wonderful and graceful jaçana, or "lily trotter" (*Actophilus africanus*).

On the more or less flooded plains, which at the time of my visit in July were fast drying up, were many plovers, small wading birds, and quantities of the African painted snipe (*Rostratulus capensis*). Everywhere, in fact, birds too numerous to mention met the eye. In the papyrus swamp there were numbers of the larvæ of a large moth, perhaps a Saturniid. These, which are mentioned by Livingstone, are said to be still more numerous at other times of the year. On the shores, more particularly of the islands, I found patches of jungle, somewhat different in character from the "msitu" above described. They are much more largely composed of dense and tangled thickets, the larger trees being comparatively few and far between. These thickets are locally called "mateshi," and on the shores of the mainland, especially near the river mouths, are the favourite resort of elephants.

In this country east of Lake Bangweulu, the ground, especially near the sources of rivers and streams, exhibits that peculiar kind of marsh so well described as "sponges" by Livingstone in his 'Last Journals.' These sponges are generally covered with a cushion of short wiry grass and matted marsh-loving plants. They remain more or less water-logged throughout the whole year, including the dry season.

The highly mineralized area of Katanga, on the Congo side of the watershed, belongs also to this "high plateau region," but presents some special features. It is, for the most part, somewhat mountainous and broken country.

The copper belt is clearly delineated by the bare hills which are to be seen everywhere within it. This peculiarity, which is due to the copper ore in the ground preventing the growth of trees, is very unusual in this part of Africa. Everywhere else, except when absolutely precipitous, the hills and mountains are covered by woodland, thus giving a characteristically "woolly" appearance to the landscape. To the north of the copper area we begin to get into lower ground, but the high ground still remains as huge island plateaus. These have usually well-defined and sometimes precipitous edges. As examples of them may be

cited the "Biano" plateau, between the Lualaba and Lufira rivers, and the still larger Kundelungu plateau, between the latter river and the Luapula. These isolated areas of elevated land are seldom inhabited by natives. Their top is usually flat or nearly so, and is covered with somewhat wide open plains interspersed with woodland. The fauna of these spots does not differ materially from that found at similar elevations to the west in Angola, or to the east in Rhodesia. In the high ground, west of the copper belt, not far from the watershed, especially near the upper Lufupa river, there are present certain peculiar features in the landscape. These are numerous plains or undulating areas of curious moorlike ground, covered only with stunted grasses and plants. Somewhat similar country may be found to the south-east of Lake Bangweulu. Here there are a number of rather similar open plains, which are remarkable for being the only spot where the "tsessebe" antelope exists in this part of Africa.

Having now described some of the more striking features of this elevated region, we may now discuss its fauna in general. On the whole, it closely resembles that which occurs throughout a wide area in Central Africa at the same elevation, in the form of varying-sized islands, lying among the more typically tropical fauna of the lower ground. Thus our area has close faunistic affinities with the interior of Southern Angola on the one hand, and the plateaus to the north on the other, including those both east and west of Lake Tanganyika, even up to the Victoria Nyanza. Though true in the main of the whole animal kingdom, this applies more especially to insects. In the case of birds, which, as might be expected, range more widely, we already find a certain proportion of western tropical forms. In comparing the larger mammals of this high country with those of the Luangwa valley, we find that many of the characteristically southern and eastern species are absent. As already pointed out, the giraffe and blue wildebeeste disappear, and impala, bushbuck, and kudu become extremely local. The puku, on the other hand, is very abundant, and seems to belong to a somewhat larger race. Among the animals not represented in the Luangwa valley may be mentioned the "situtunga" (*Tragelaphus selousi*) and the black lechwe (*Cobus lichi smithemani*, Rothsch.).

Crawshay's sing sing water-buck (*Cobus defassa Crawshayi*) has also replaced the common water-buck of the Luangwa valley.

Among the birds of this area, which are of interest from the point of view of geographical distribution, is a yellow-helmeted Guinea-fowl (*Numida marungensis*), originally discovered near the west shore of Lake Tanganyika. Once the Mchinga escarpment is ascended, this seems to be the only Guinea-fowl over a wide area, those of the Luangwa valley, the common species (*N. Mitrata*), and the beautiful crested Guinea-fowl (*Guttera edouardi*) disappear altogether.

Innumerable other instances throughout the animal kingdom might be given of the differences between the high plateau fauna and that of the Luangwa valley. One of the most instructive things a student of geographical distribution can do is to climb the 3000 feet or thereabouts of the Mohinga escarpment, out of the low-lying Luangwa valley, and find himself in a new world of animals and plants.

I cannot leave the high ground without making some reference to the flowers, which are much more in evidence than at lower elevations. Among the more striking are many species of Gladioli inhabiting the most diverse situations, some growing among the swamps, others among the rocks on the hillsides. In spring the grassy, somewhat swampy ground is gay with Tritomas, Crinums, and Convolvuli. Autumn is another time which is characterized by abundance of flowers, more especially in the woodland. At this time the woods are gay chiefly with Compositæ. Some very handsome cornflowers also especially call for notice, particularly a large blood-red one.

This, then, is a brief and necessarily inadequate description of the high plateau of this part of Central Africa. It is a land with a moderate and equable climate, where the sun is seldom if ever really troublesome. Of great natural beauty, and swarming with game, it is a paradise for the traveller, only marred by the native methods of agriculture and the consequent difficulties of food supplies. It is eminently suited for, and doubtless will one day become, the home of a white race.

We now come to our third and last faunistic district. This area is confined to the river-valleys and low ground within the Congo basin. In North-Eastern Rhodesia it is limited to the lower Luapula and Kalungwisi valleys, the shores of Lake Mweru, and to a less degree the shores of Lake Tanganyika and the lower Lofu valley. Within the Congo Free State this area, of course, comprises all the low ground in the river basins. The fauna of this area is closely allied to that of the tropical west coast. I did not personally visit the actual shore of Lake Tanganyika, but from a short inspection of the lower Lofu valley, it would appear that its fauna is a mixture of those animals characteristic of the western and eastern tropical regions.

The course of the above-mentioned rivers, both in British and Congo territories, all exhibit much the same history. Their upper waters pass through the more or less flat plateau country just described, the fauna of their banks not differing from that of the surrounding country. As soon, however, as they begin to descend from the high ground, these rivers, with few exceptions, pass through a series of gorges, and their banks, instead of being only slightly, or not at all, wooded, begin to be edged with more or less tropical forest. This is very well exemplified by the Lualaba river. This river, which, when on the flat plateau is nearly 100 yards wide, is suddenly compressed between two huge rocks

at the point where it enters the gorge, and becomes for a short distance a boiling torrent less than 20 feet across.

The presence of these tropically forested banks coincides with the appearance of a western tropical fauna, and also, as I am pointing out elsewhere,* with the occurrence of *Glossina palpalis*, the tsetse fly, which, as is well known, carries Sleeping Sickness.

Thus our third area, which begins as narrow strips following the course of the lower portion of the main rivers of the Congo basin, increases in extent as the low ground is reached. This low country in the Congo basin has a vague general resemblance to that already described in the basin of the Zambezi. The actual fauna and flora are, however, altogether different. In the grassy alluvial flats, palms, etc., are much more numerous, and the baobab has disappeared.

The woodland is much more dense, and here and there merges into forest. The fauna, more especially the insects and the birds, particularly the smaller Passerines, is characteristic of that of the tropical west coast, and this character becomes more and more marked the further one advances down the tributaries of the Congo. To demonstrate the faunistic differences between these forested river-banks of the Congo basin, and somewhat similar localities, we may take an instance among the butterflies. The characteristically large and gorgeous western tropical genus Euphædra is well represented in these Congo river-valleys. I took there myself some nine species, including one which also occurs throughout the high plateau. In the valley of the Zambezi, on the other hand, and indeed throughout the eastern tropical coast, this genus is only represented by a single somewhat aberrant species.

It has now been shown that this part of Southern Africa comprises two low-lying districts separated by a wide area of high ground, and that each is characterized by a distinct fauna. It has been the object of this paper to demonstrate that the Congo-Zambezi watershed and the high land on each side of it has caused this faunistic difference. For a considerable geological epoch this high ground must have kept separate much of the animal life, inhabiting the low ground in each of the river-basins, just as it serves to separate the waters of the two great rivers.

The PRESIDENT (before the paper): Mr. Neave, who has kindly consented to lecture here to-night, is a naturalist who has spent about two years in South Central Africa. He has been studying the Congo-Zambezi watershed with a view to ascertaining its influence on the distribution of animals and plants in that interesting region, and it is the result of these two years' travelling he is going to describe to us to-night. I am glad to say Mr. Neave, since he has returned to England, has been appointed by the Colonial Office a member of the Entomological Research Committee which is about to proceed to British East Africa in order to

---

* *Journal of Economic Biology*, vol. 4, pt. 4, p. 109 *sqq.*

study insect life in those regions, more especially with a view of ascertaining whether there is any way of preventing the diseases which these insects give rise to in human beings.

Dr. P. L. Sclater: I am afraid I can offer but a very few remarks on the excellent paper we have just heard read. My personal experience has been confined entirely to the Cape Colony and the extreme southern portion of Africa, but I look forward with very great interest, as a naturalist, to the exploration of these northern provinces that has been lately commenced. There is no doubt that when Mr. Neave's large collections come to be worked out, as they will be, with the help of his friends at the British Museum, we shall advance very much in our knowledge of the fauna of South Africa. In the works that my son, Mr. William Sclater, formerly of Cape Town, has published on the mammals and birds of South Africa, I am pleased to see that he has anticipated, I might almost say, the very divisions, between the northern and southern faunas to which Mr. Neave has alluded in his paper. Mr. Neave has made wonderful discoveries in a very short period. He has carried out two successful expeditions through these northern parts of South Africa, and I am pleased to hear that he is now about to return to Africa to take up exploration in another quarter. I am sure we shall all join in wishing him success.

Mr. William Sclater: I have very little to add to what my father has said. My studies have been almost entirely confined to Africa south of the Zambezi. In the works which my father so kindly alluded to, that river was the boundary which I took for the fauna of South Africa, and I had very little to do with fauna north of the Zambezi, although I was always naturally very interested in it. Before Mr. Neave went out on the geodetic survey, Dr. Storr, who was the medical officer of the geodetic survey with which Mr. Neave was afterwards connected, collected a large number of birds, which I had the pleasure of working out at the Cape. Among them there were a number of very interesting species, which seemed to point to the same results that Mr. Neave has told us about, namely, that the high plateau between the Zambezi valley on the one side, and the Congo on the other, formed the boundary of the South African fauna. I have naturally listened to Mr. Neave's paper with great interest, and I think you will all join with me in wishing him success in his future investigations in East Africa.

Mr. Ogilvie-Grant: I am afraid I was not aware that I should be called on to make any remarks this evening, so I am hardly prepared to do so, and I do not think I can add very much to what has already been said. There is one thing, however, I should like to say: Mr. Neave has not told us much about his collections, and as a rule we are accustomed to have large collections sent home with very insufficient field-notes. Now, Mr. Neave has excelled greatly in this point, and I think I may say he is certainly one of our very best field-observers. On butterflies, especially, we are accustomed to read papers which are extremely dry and uninteresting, but Mr. Neave has just forwarded to the Zoological Society of London a very fine report on his collection of butterflies, which is teeming with interesting field-notes on their life-history, and I think in this particular respect he is almost unique. His notes on his other zoological collections are of equal value and interest.

Mr. H. Wilson Fox: It is very difficult for any one who cannot claim technical qualifications to add anything to what Mr. Neave has given us this evening, but speaking rather more from a commercial point of view than is perhaps usual in this hall, I feel this, that any one who is interested in the future development of these territories, and realizes the value of fresh information, is extremely indebted to a worker of the character of Mr. Neave. The generalisations which we have listened to to-night have, I think, taught many of us who thought we knew

something of this region, a great deal of our own ignorance. I must confess, as one who has been in a portion of that region, that I have learned much that has been new to me, and I have been specially interested in the allusion which Mr. Neave made to-night to the character of the native inhabitants of those regions. It is one of the most difficult problems that people in a new country have to deal with, how to make their work fit in, if I may say so, with the native habits, so as not to dislocate the order of ideas to which natives are accustomed too rapidly. We have to develop those territories in the best way possible, so as to make the best use of the material at our disposal. We have to displace the primitive methods of agriculture with something that is better, and to teach methods that will enable natives to satisfy their wants with less effort and better results than is possible at present. That great work, I hope, is being done gradually and effectively by the posts which the Administration of the British South Africa Company is establishing throughout these vast territories, of which you have got an illustration to-night in the admirable photograph which Mr. Neave has shown us of the post which was being established in the extreme north at the time of his visit.

Dr. ARTHUR HAYDON: There is one point we have just heard a little about, and that is of the progress which is being made in the treatment of sleeping-sickness. We have seen various models of houses, and some example of the inoculation treatment. I should like to know what progress is being made in the control of the disease under the present conditions.

Mr. NEAVE: I think I might say very stringent regulations are being made in Northern Rhodesia to prevent the spreading of it, but I think it is more a question to be answered by the Administration of the country than by myself.

The PRESIDENT (after the paper): Mr. Neave has shown us how the highlands separate the country into three districts; how they prevent migration of animals from one part to another; and how they have created districts where the process of evolution has run different courses. To-night's paper is, in fact, the account of a Boundary Commission dealing with the boundaries between various animal kingdoms, and I am sure you will wish me in your name to thank Mr. Neave for the charming description he has given of his labours in this direction. All the speakers have joined in wishing good luck to Mr. Neave on his coming mission to Africa, and have expressed their sincere hope, in which we all join, that these labours will be successful.

THE CYCLE OF MOUNTAIN GLACIATION.*

By Prof. WILLIAM HERBERT HOBBS, University of Michigan.

CONTENTS.

THE CIRQUE AND ITS RECESSION.

Introduction—Mountain *versus* continental glaciers—The glacial amphitheatre in literature—Relation of cirque to Bergschrund—The Schrundline—Initiation of the cirque—Nivation.

---

* Read before the Section of Geography of the British Association for the Advancement of Science at the Winnipeg meeting, August 27, 1909. When not otherwise credited, the views reproduced in this paper are from photographs taken by the author, mainly during the summers of 1908 and 1909.

SCULPTURING OF THE UPLAND.

The upland dissected—Modification in the plan of the cirque as maturity is approached—Grooved and fretted uplands—Characteristic relief-forms of the fretted upland—The col and its significance—The advancing hemicycle.

CLASSIFICATION OF GLACIERS BASED UPON COMPARATIVE ALIMENTATION.

Relation of glacier to its bed—Nivation type—Ice-cap type—Piedmont type—Transection type—Expanded-foot type—Valley or dendritic type—Tidewater type—Inherited basin type—Alpine type—Horseshoe type.

TERMINATION OF THE CYCLE OF GLACIATION.

Configuration of the glacier bed when uncovered—Water-erosion within the valley during retirement of the glacier.

THE CIRQUE AND ITS RECESSION.

Introduction.—With the advance of knowledge concerning the sequence of conditions affecting glaciers, it has come to be generally recognized that for any given district the factor of supreme importance is temperature, a very moderate change in the average annual temperature being sufficient to profoundly transform a district, the aspect of which is temperate, and to furnish it with snow-fields and mountain glaciers. These slight variations in average annual temperature involve less important geological changes than must be invoked in order to greatly modify the annual precipitation. Thus it has been recently estimated that a fall of but 3° (Fahr.) in the average annual temperature would result in the formation of small glaciers within the area of the Scottish Highlands, while a like fall of 12° within the Laurentian Lake district of North America would suffice to bring on a period of glaciation.

With the probability that such climatic changes would be initiated slowly, the first visual evidence of the changing condition within all districts of accentuated relief would probably be a longer persistence of winter snows in the more elevated tracts; which accumulations of snow would eventually contribute a remnant to those of the succeeding winter, and so bring on a cycle of glaciation. From this beginning the cycle is an advancing one until a culmination is reached corresponding to the most rigorous of the climatic conditions. A resumption of a more genial climate would result in a reverse series of changes, terminating so soon as the winter's fall of snow is insufficient to produce permanent snow-drifts even in the higher areas. It is therefore proper to speak of the *advancing* and the *receding hemicycles of glaciation.*

Mountain versus *Continental Glaciers.*—The land-forms which result from glaciation within districts of strong relief when not entirely submerged beneath snow and ice, are totally different from those which are sculptured beneath a glacier of continental dimensions. Examination of university text-books and experience with students have alike convinced the writer that this difference has not been sufficiently

accented. In part, this may be explained by a rather general tendency to treat the subject of erosion by glaciers in mountains from studies made especially in the lower altitudes.* A quite general neglect of those special conditions of denudation which are operative in high-level areas of glaciers is, it is believed, responsible for an over-emphasis laid upon the U-shaped trunk valley and the hanging tributary valley, important as these features are.† This over-emphasis can, perhaps, be best illustrated by reference to a series of three successive idealistic sketches, executed with great skill by an eminent American geographer, and intended to develop especially the erosion forms which result from mountain glaciers.‡ The low-level sculpturing expressed by these sketches is, in the opinion of the writer, admirable, and a true rendering of nature. It is the failure to recognize any additional process of erosion operative in higher altitudes which destroys the value of the high-level sculpturing displayed.

So far as low-level mountain glaciation is concerned, the erosive processes are pretty well understood to be identical with those of continental glaciers, namely, abrasion and plucking. The larger proportion of projecting rock-masses in the case of mountain glaciers will, however, presume a greater emphasis upon lateral undercutting from the operation of both of these processes acting conjointly. It is the operation of an additional denuding process of the first importance, head-wall erosion, that differentiates all types of mountain glaciers from continental ones. This distinguishing process is responsible for the development of the *cirque* (Ger. *cirkus*), which is known by a variety of names in different glacier districts. In Scotland it has been generally referred to as the *corrie*, in Wales as the *cwm*, and in Scandinavia as the *botn* or *kjedel* (*kessel*). In the scientific literature of the subject, the Bavarian-Austrian word *kahr* has been used with increasing frequency for the same topographic feature. In view of this diversity in resultant topography, and despite their close genetic relationships, we would do well to sharply separate in our discussions continental glaciers from all other types, which latter we may include under the broad term of mountain glaciers.

The Glacial Amphitheatre in Literature.—It is safe to say that no topographic feature is more characteristic of the mountains which have

---

* "The visitor replied that he was a valley climber, not a mountain climber. He found sufficient pleasure at the mountain base, and such was my case also. Mountain-tops are indeed worthy objects of a climber's ambition, but if one wishes to get at the bottom facts, let him examine the valleys" (W. M. Davis, "Glacier Erosion in the Valley of the Ticino," 'Appalachia,' vol. 9, 1901, p. 137).

† On hanging valleys, see especially W. M. Davis, *Proc. Boston Soc. Nat. Hist.*, vol. 29, 1901, pp. 273–322; and G. K. Gilbert, 'Harriman Alaska Expedition,' vol. 3, "Glaciers."

‡ W. M. Davis, "The Sculpture of Mountains by Glaciers," *Scot. Geogr. Mag.*, vol. 22, 1906, figs. 1–3.

been occupied by glaciers than is the cirque. Approaching a range from a considerable distance, there is certainly no form which so quickly forces itself upon the attention. The U-shaped valley and the hanging side valley, important as these are, are here decidedly less impressive. Yet the great majority of works upon the subject, by ignoring the significance of the cirque, allow the reader to assume that the glaciers discovered the cirques ready formed to gather in the snows for their nourishment. Even the standard work of Chamberlin and Salisbury is open to this objection.*

Despite the attitude of the general texts, which so largely determine what might be called the accepted body of doctrine of a science, there are a number of papers dealing with the origin of the cirque. One of the first to recognize the cirque as a product of glacial erosion was Tyndall, whose keen mind has so illumined the page of mountain glaciation.† In opposition to his view, Bonney published in 1871 a somewhat elaborate article, in which the line of argument was: (1) that the Alpine cirques must have been produced by the same agency which shaped the valleys below them; (2) that the valleys were not moulded by glaciers; and hence, (3) the cirques must have been retained from the pre-glacial land surface.‡ The published discussion of this paper developed no opposition to the view, though Doctor, now Sir Archibald, Geikie stated that he could not see his way to account for the vertical walls surrounding the cirque. On the other hand, the Italian Professor Gastaldi recognized the work of the ice in the shaping of cirques in the Italian Alps,§ as Helland did in those of Norway. The latter believed that excessive weathering in the rock above the *névé* played an important *rôle*, though abrasion by the ice upon the floor was the larger factor.‖ Later, Russell in America,¶ Wallace in England,** and de Martonne on the continent,†† further advocated the glacial origin of cirques. Penck has explained the development of cirques as the

* 'Geology,' vol. 1: "Processes and their Results," 1904, pp. 272–276, and especially fig. 250. See also 'College Geology,' by the same authors, 1909, p. 256.

† John Tyndall, "On the Conformation of the Alps," *Phil. Mag.*, Ser. 4, vol. **24**, 1862, pp 169–173.

‡ T. G. Bonney, "On the Formation of 'Cirques,' with their Bearing upon Theories attributing the Excavation of Mountain Valleys mainly to the Action of Glaciers," *Quart. Jour. Geol. Soc.*, vol. **27**, 1871, pp. 312–324.

§ B. Gastaldi, "On the Effects of Glacier-erosion in Alpine Valleys," *ibid.*, vol. **29**, 1873, pp. 396–401.

‖ Amund. Helland, "Ueber die Vergletscherung der Färöer, sowie der Shetland und Orkney Inseln," *Zeitsch. d. Deutsch. Geol. Gesellsch.*, vol. **31**, 1878, pp. 716–755, especially pp. 731–738.

¶ I. C. Russell, "Quarternary History of Mono Valley, California," '8th Ann. Rept. U.S. Geol. Surv.,' 1889, pp. 352–355.

** A. R. Wallace, "The Ice Age and its Work," *Fortnightly Review*, vol. **60**, 1893, especially p. 757.

†† E. de Martonne, "Sur la période glaciaire dans les Karpates méridionales," *C. R. Acad. Sci. Paris*, vol. **129**, 1899, pp. 894–897; *ibid.*, vol. **132**, 1901, p. 362.

result of sub-glacial weathering—alternate thawing and freezing—beneath glaciers during the incipient stage particularly ("hanging glaciers").* This eroding process, he considered, would be greatest toward the middle of the glacier, so that the original concavity of the slope beneath it would be more and more deepened. It must be evident that this explanation does not properly account for the steepness of the cirque walls, which it will be remembered could not be accounted for by Geikie.

Attention was again directed to the process of cirque shaping by an important paper of Richter's published in 1896.† His studies having been made in Norway, where a country rounded and polished by the continental glacier had been only partly invested by mountain glaciers, the cirques from the latter formed individual "niches" in the uplands. Following Gastaldi, the form of these niches was happily likened to that of an armchair (see Fig. 1).‡ Richter observed that the steep

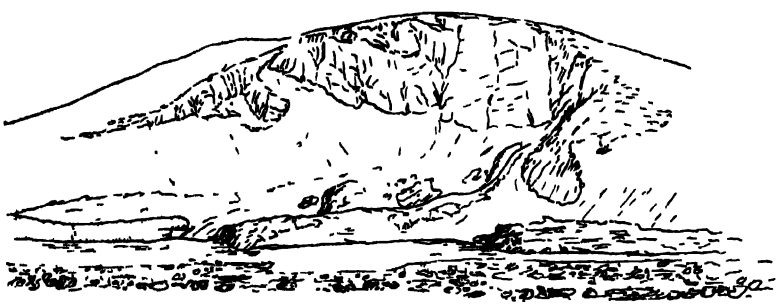


FIG. 1.—A GLACIAL CIRQUE EXCAVATED FROM THE PLEISTOCENE GLACIATED SURFACE OF NORWAY. THE NORTHERN KJEDEL ON GALDHOPIG. (AFTER E. RICHTER.)

walls of the cirque were the only surfaces unglaciated, and hence he concluded that they were not to be ascribed to ice-abrasion, but to weathering. The moulding of the cirque floor he ascribed to abrasion, and, referring to the cirque walls, said—

"The material loosened by weathering is removed by the glacier or slides off over the *névé* to form either actual moraines, or, at least, *névé* moraines. These walls do not bury themselves in their own *débris*, and in consequence continually offer fresh surfaces for attack. Finally, the wearing away of the cirque floor by the glacier co-operates to keep the cirque walls on a steep angle and facilitates avalanching."

---

* Albrecht Penck, 'Morphologie der Erdoberfläche,' vol. 2, 1894, pp. 307–308, figs. 17–20.

† E. Richter, "Geomorphologische Beobachtungen aus Norwegen," *Sitzungsber. Wiener Akad., Math.-Naturw.-Kl.*, vol. 105, 1896, Abt. I., pp. 152–164, 2 pls. and 2 figs.

‡ See topographic definition of the cirque by De Martonne ("La periode glaciaire dans les Karpates meridionales," *C.R.*, 9e Cong. Geol. Intern., Vienna, 1903, pp. 694, 695).

In a more extended and later paper,* treating especially the formation of cirques, Richter has explained that his view differs from that of Helland only in ascribing greater importance to weathering upon the cirque walls and less to abrasion upon the cirque floor. Inasmuch as the excessive weathering of cirque walls, as maintained by Richter, is above the surface of the *névé*, a horizontal plane of denudation should develop at that level. No evidence of this plane being discovered, its absence is explained by Richter through abrasion from the snowbank which would collect upon it so soon as formed. This is the fatal weakness of the Richter hypothesis.

Relation of Cirque to Bergschrund.—Up to the beginning of the twentieth century, as we have seen, few geologists had greatly concerned themselves with the erosion conditions at high levels, the work of Richter being on the whole the most comprehensive. The whole subject of cirque erosion was rather generally ignored, as it is indeed to-day. Sir Archibald Geikie, referring to the corries of the Scottish Highlands,† wrote—

"The process of excavation seems to have been mainly carried on by small convergent torrents, aided of course by the powerful co-operation of the frosts that are so frequent and so potent at these altitudes. Snow and glacier ice may possibly have had also a share in the task."

Writing in the same year, Reusch ascribed the Norwegian cirques to the action of surface water descending through the crevasses over falls in the continental glacier which, in Pleistocene times, overrode the country;‡ and the following year, Bonney reiterated his view that cirques were the product of water-erosion.§ Only a few years before, Gannett had curiously explained the origin of cirques through the wear of avalanched snow and ice upon the cirque floor, likening the erosive process to that which takes place beneath a waterfall.‖

The discovery of the method by which the glacier excavates its amphitheatre must be credited to a keen American topographer-geologist, Mr. Willard D. Johnson of the United States Geological Survey.¶ In

* E. Richter, "Geomorphologische Untersuchungen in den Hochalpen," *Pet. Mitt.*, Ergänz. Heft 132, 1900, pp. 1–103, pls. 1–6.

† 'Scenery of Scotland,' p. 183 (revised in 1901).

‡ H. Reusch, 'Norges Geologiske Undersögelse,' No. 32, Aarbog for 1900, 1901, pp. 259, 260.

§ "Alpine Valleys in Relation to Glaciers," *Quart. Jour. Geol. Soc.*, vol. 58, 1902, p. 699.

‖ "The effect is precisely like a waterfall. The falling snow and ice dig a hollow depression at the foot of the steep descent just as water does" (*Nat. Geogr. Mag.*, vol. 9, 1898, p. 419).

¶ W. D. Johnson, "An Unrecognised Process in Glacial Erosion" (read before the Eleventh Annual Meeting of the Geological Society of America), *Science*, N.S., vol. 9, 1899, p. 106; also "The Work of Glaciers in High Mountains" (lecture before the National Geographic Society), *ibid.*, pp. 112, 113. The first public formulation of the doctrine by Mr. Johnson was in an address before the Geological Section of the Science Association of the University of California, delivered September 27, 1892.

fact, to him and to another American topographer, Mr. François E. Matthes, we owe the most of what is known from observation concerning the initiation and the development of the glacier cirque. Reasoning that abrasion was incompetent to shape the amphitheatre, Johnson early surmised that the great gaping crevasse which so generally parallels the cirque wall and is termed the *Bergschrund*, went down to the rock beneath the *névé*, and that it was no accident that glaciated mountains alone "abound in forms peculiarly favourable to snowdrift accumulation." These observations were made as early as 1883, and in order to test his theory, Johnson allowed himself to be lowered at the end of a rope 150 feet into the Bergschrund of the Mount Lyell glacier until he reached the bottom. He found a rock floor to stand upon, and rock extended up for 20 feet upon the cliff-side. We may here quote his terse sentences, since too little attention has been accorded this important observation.*

"The glacier side of the crevasse presented the more clearly defined wall. The rock face, though hard and undecayed, was much riven, the fracture planes outlining sharply angular masses in all stages of displacement and dislodgment. Several blocks were tipped forward and rested against the opposite wall of ice; others quite removed across the gap were incorporated in the glacier mass at its base."

Everywhere in the crevasse there was melting, and thin scales of ice could be removed from the seams in the rock. The bed of the glacier, elsewhere protected from frost-work, was here subjected to exceptionally rapid weathering. By maintaining the rock wall continually wet, and by admitting the warm air from the surface during the day, diurnal changes of temperature here resulted in very appreciable mechanical effects, whereas above the *névé* only the seasonal effects were important.

This observation of Johnson is, it will be observed, in contrast with the suppositions of Richter, who believed that the maximum sapping upon the cirque wall occurred above the surface of the *névé*. The function of the Bergschrund, which separates the stationary from the moving snow and ice within the *névé*, is thus found to be of paramount importance in the shaping of the amphitheatre.

The Schrundline.—That a sharp line is observable in abandoned cirques separating the accessible from the non-scalable portions of the wall, has been pointed out by Gilbert, who has given his support to the view of Johnson, and confirmed it by observations of his own.† Penck, on the other hand, the following year revived the view of Richter that excessive sapping occurs upon the cirque walls *above* the *névé* surface,

---

* W. D. Johnson, "Maturity in Alpine Glacial Erosion," *Jour. Geol.*, vol. 12, 1904, pp. 569–578 (read at Intern. Congr. Arts and Sciences, St. Louis, 1904).

† G. K. Gilbert, 'Systematic Asymmetry of Crest-lines in the High Sierras of California," *Jour. Geol.*, vol. 12, 1904, pp. 579–588. See also E. C. Andrews, *ibid.*, vol. 14, 1906, p. 44.

though he calls in the Bergschrund in order to gather in and remove the rock fragments which fall from the cliff.*

Initiation of the Cirque—Nivation.—Johnson's studies upon the processes of cirque shaping, had shown how a nearly perpendicular cirque wall is steadily cut backward through basal sapping at the bottom of the Bergschrund. The problem of how the snowbank, which was the inevitable forerunner of the glacier, had transformed the relatively shallow depression which it presumably discovered into the steep-walled amphitheatre, he did not attempt to solve. Yet the nourishing catchment basin is a prerequisite to the existence of the normal glacier. The solution of this problem has been suggested by another American topographer, Mr. F. E. Matthes.† In the Bighorn mountains of Wyoming he has found exceptional opportunities for this study. Owing to the low precipitation within the region and the consequently inadequate nourishment of

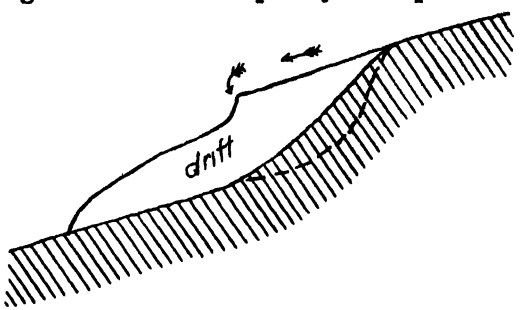


FIG. 2.—CROSS-SECTION OF A STEEP SNOWDRIFT SITE, SHOWING RECESSION BY NIVATION. (AFTER MATTHES.)

glaciers, a large part of the pre-glacial surface still remains. There is, therefore, represented within the district every gradation from valleys which were occupied by snow during a portion only of the year to those which were the beds of glaciers many miles in length. Both small glaciers and high-level drifts of snow still remain in a number of places.

Mr. Matthes has demonstrated that the snowbanks without movement steadily deepen the often slight depressions within which they lie by a process which he has called *nivation*—excessive frost-work about the receding margins of the drifts during the summer season. The ground being continually moist in this belt due to the melting of the snow, the water penetrates into every crevice of the underlying rock, so that it is rent during the nightly freezing. Rock material thus broken up and eventually comminuted is removed by the rills of water from the melting snow.‡ By this process the original depression is deepened, and, if upon a steep slope, its wall becomes recessed (see Fig. 2).

* Albrecht Penck, "Glacial Features in the Surface of the Alps," *Jour. Geol.*, vol. 13, 1905, pp. 15–17.

† François E. Matthes, "Glacial Sculpture of the Bighorn Mountains, Wyoming," '21st Ann. Rept. U.S. Geol. Surv.,' 1899–1900, pp. 167–190.

‡ Mainly in later seasons.

The occupation of a V-shaped valley by snow, as Matthes has further shown, tends through the operation of this process to transform it into one of U-section, since the weathered rock material upon the slopes is transported by the rills and deposited upon the floor. All gradations from nivated to glaciated forms are to be found in the Bighorn range.

During the past field season the writer has taken the opportunity to examine *névé* regions and high-level snowbanks in a number of districts, with the result of confirming the importance of the nivation process as outlined by Matthes. In Figs. 3 and 4 are shown two snowbanks which were photographed on July 25 near the summit of Quadrant mountain, in the Gallatin range of the Yellowstone National Park. The gently sloping surface of this mountain represents the pre-Glacial upland unmodified by Pleistocene glaciation. Though between 9000 and 10,000 feet in height, it supports a rich herbage, and is a favourite grazing-ground of the elk. In Fig. 3 the snowbank is seen surrounded by a wide zone within which no grass is growing, but where a finely comminuted brown soil is becoming a prey to the moving water. Fig. 4 exhibits another bank lying in the depression which it has largely hollowed. At its lower end (at the left) is seen an apron of fine brown mud deposited by the over-burdened stream as it issues from beneath the drift.

An interesting question is at what point the snow-field or *névé* will, by taking on a motion of translation, assume the functions of a glacier. At this stage of transition the Bergschrund should first make its appearance. Comparison of nivated and glaciated slopes in the Bighorn mountains led Matthes to think that upon a 12 per cent. grade the *névé* must attain a thickness of at least 125 feet before motion is possible. Another possible method of approaching this problem has suggested itself to the writer. In mountains like the Selkirks, with steep slopes terraced by the flatly dipping layers in the rock, a peculiar type of small cliff glacier is nourished high above the larger snow-fields of the range and avalanched upon the lower shelves so as to leave vertical sections open to study (see Fig. 5). Perhaps because of their small size these cliff glaciers have not developed cirques, though a Bergschrund parallels the generally straight head-wall. Examined through a powerful glass, the snow in the lower layers can be seen to have lost its brilliant whiteness, though it does not yet appear as ice. A number were examined with a view to determine the approximate minimum thickness of the glacier, but all exceed the minimum estimate of Matthes by at least 100 feet. This is not regarded as in any way discrediting his figure, but rather as suggesting the possibility of more thorough examination along the same line.



1



2



3



4

Miles

0 1 2

PLATE I —SERIES OF FOUR MAPS TO ILLUSTRATE THE PROGRESSIVE DISSECTION OF AN UPLAND BY MOUNTAIN GLACIERS

Fig 1 —Early stage of glaciation (Cloud Peak Quadrangle Wyoming)
Fig 2 —Further investment of the upland, producing a *crowned upland* (Cloud Peak Quadrangle, Wyoming)
Fig 3 —Early maturity (Leadville Quadrangle, Colorado)
Fig 4 —Complete dissection at maturity [illegible]

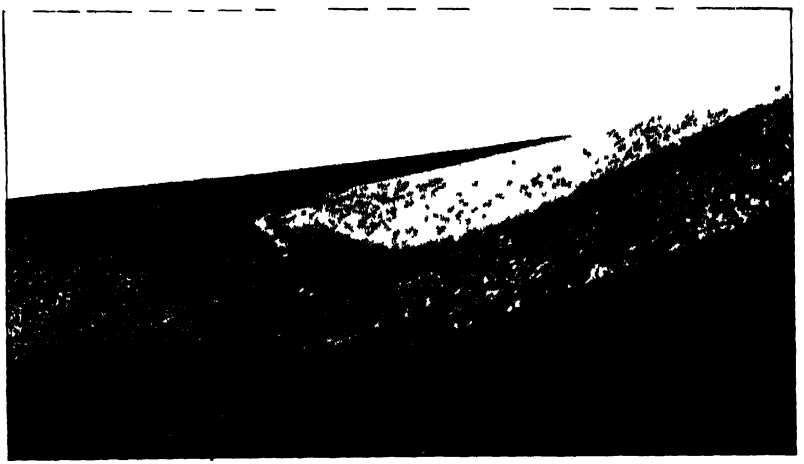


FIG. 3.—SUMMER SNOWBANK SURROUNDED BY BROWN BORDER OF FINELY COMMINUTED ROCK. QUADRANT MOUNTAIN, Y.N.P.



FIG. 4.—SNOWBANK LYING IN A DEPRESSION LARGELY OF ITS OWN CONSTRUCTION. NOTE STREAM OUTWASH OF FINE MUD AT THE LEFT. QUADRANT MOUNTAIN, Y.N.P.

Sculpturing of the Upland.

The Upland dissected.—Having obtained a clear conception of the process of head-wall erosion through basal sapping, Johnson was in a position to account for the topography which he encountered in the High Sierras of California. This topography is best described in his own words *—

"In ground plan the canyon heads crowded upon the summit upland, frequently intersecting. They scalloped its borders, producing remnantal table effects. In plan as in profile, the inset arcs of the amphitheatres were vigorously suggestive of basal sapping and recession. The summit upland—the pre-Glacial upland beyond a doubt—was recognizable only in patches, long and narrow and irregular in plan, detached and variously disposed as to orientation, but always in sharp tabular relief and always scalloped. I likened it then, and by way of illustration I can best do so now, to the irregular remnants of a sheet of dough on the biscuit board after the biscuit tin has done its work."

In a portion of the region where Johnson's studies were made, his views have received verification by Lawson in a beautifully illustrated paper.† Davis has furnished an excellent example from the Tian Shan mountains of the operation of the same cirque-cutting process, recording his adhesion to the Johnson doctrine,‡ though his later papers would indicate that he does not ascribe large importance to the discovery.§

With little doubt the failure to generally recognize the importance of this process of cirque recession, clearly here a more effective agent than abrasion, is to be explained by the fact that in Europe generally, and in the Alps in particular, one looks in vain for evidences of the earlier and more significant stages of the process. Glaciation was here so vigorous as to cause the removal of all summit upland. Within the arid regions of the western United States, a more fruitful field for study is to be found. Here the work of Johnson has been supplemented by that of Gilbert‖ and Matthes.¶ Perhaps nowhere are the early stages of the process so clearly revealed as in the Bighorn mountains of Wyoming (see Fig. 6).

A somewhat more advanced stage of the same process is to be found in the Uinta mountains of Wyoming, recently described in a valuable monograph by Atwood, though here without consideration of the

---

* W. D. Johnson, *Jour. Geol., loc. cit.*

† A. C. Lawson, "The Geomorphogeny of the Upper Kern Basin," *Bull. Dept. Geol. Univ. Calif.*, vol. 3, No. 15, especially pp. 357–362 and pls. 32 and 45.

‡ W. M. Davis, "A Flat-topped Range in the Tian Shan," 'Appalachia,' vol. 10, 1904, pp. 279–280.

§ *E.g.*, cf. *Scot. Geogr. Mag.*, vol. 22, 1906, pp. 76–89.

‖ *Jour. Geol., loc. cit.* ¶ *Ibid., loc. cit.*

cirque-cutting process in accounting for the present topography.* Yet nowhere, so far as the present writer is aware, has a view been reproduced which so well illustrates the remnantal tableland and the "biscuit-cutting" process of cirque recession (see Fig. 7).† The present writer has photographed other examples of the same type in the Yellowstone National Park (see Figs. 8 and 14). Remnants of the pre-Glacial surface will, in any given district, be large or small according as nourishment of the glaciers has been insufficient or the reverse. The Uinta range, which extends in an east-west direction, and, like

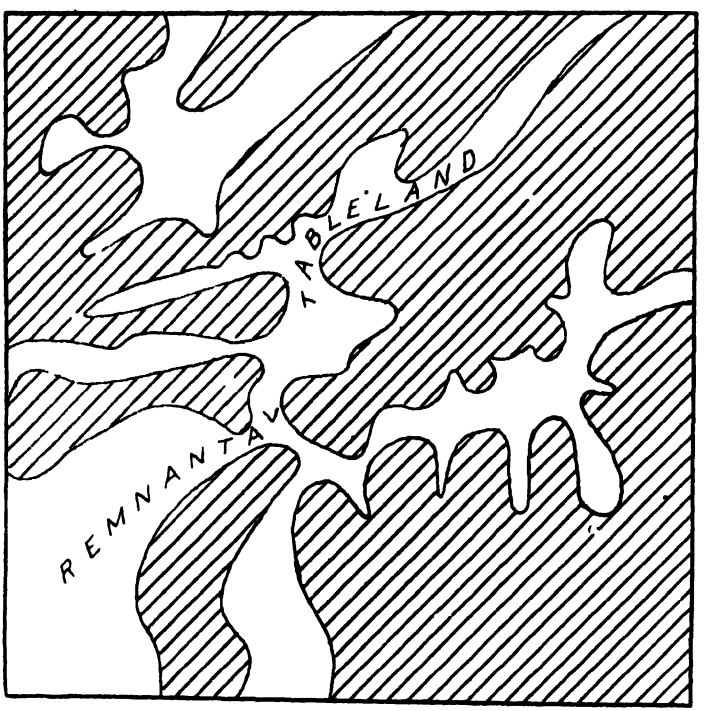


FIG. 6.—PRE-GLACIAL UPLAND INVADED BY CIRQUES, "BISCUIT CUTTING" EFFECT, BIGHORN MOUNTAINS, WYOMING.

the Bighorn mountains, has a core of homogeneous granitic rock, displays this fact. An examination of Atwood's map ‡ shows that to the eastward, where the precipitation has been least, the remnants of the original upland are more considerable. This qualifying condition

* Wallace W. Atwood, 'Glaciation of the Uinta and Wasatch Mountains,' Prof. Paper, U.S. Geol. Surv., No 61, 1909, pp 1-96, pls. 1-15.

† Other apt illustrations have been furnished by Lawson in a photograph taken the Upper Kern region of the California Sierras (*loc. cit.*, pl. 32 B), and by Davis in sketch made in the Tian Shan mountains ('Appalachia,' vol. 10, 1904 p. 279).

‡ *Loc. cit.*, pl. iv.



FIG. 5.—VIEW OF THE YOHO GLACIER AT THE HEAD OF THE YOHO VALLEY, SHOWING TO THE RIGHT A SERIES OF THREE SMALL CLIFF GLACIERS. CANADIAN ROCKIES.

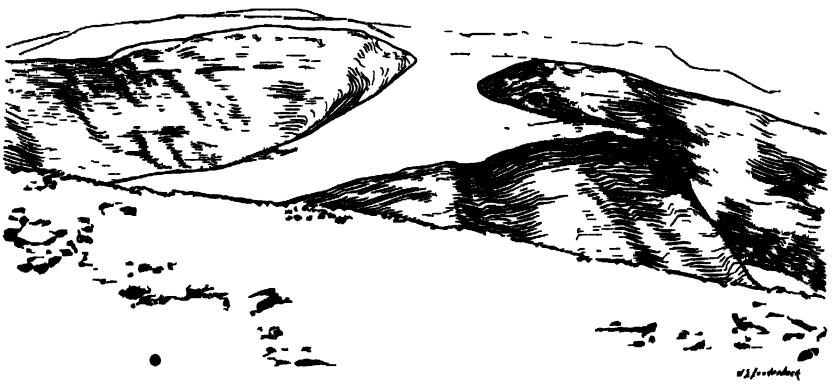


FIG. 7.—VIEW OF THE SCALLOPED TABLELAND WITHIN THE UINTA RANGE, AND NEAR THE HEAD OF THE WEST FORK OF SHEEP CREEK. (AFTER ATWOOD.)



FIG. 8.—PRE-GLACIAL UPLAND ON QUADRANT MOUNTAIN, Y.N.P., INVADED BY THE CIRQUE KNOWN AS THE "POCKET."



FIG. 11.—MULTIPLE SECONDARY CIRQUE ON THE WEST FACE OF THE WANNENHORN SEEN ACROSS THE GREAT ALETSCH GLACIER, TO WHICH IT IS TRIBUTARY.

of glacier nourishment will be subject to some modification because of peculiarities in snow-distribution. As shown by Gilbert, the first glaciers within any mountain district will probably appear upon that side of the divide which is in the lee of the prevailing winds. This fact is particularly well brought out in Fig. 9.

Modification in the Plan of the Cirque as Maturity is approached.—Owing to the fact that the sapping process within the cirque operates on all sides, its early plan, when the upland surface is supplying snow from all directions, will approach the circle (see Figs. 6 and 8). Moreover, in this stage the cirque will be but little, if any, wider than

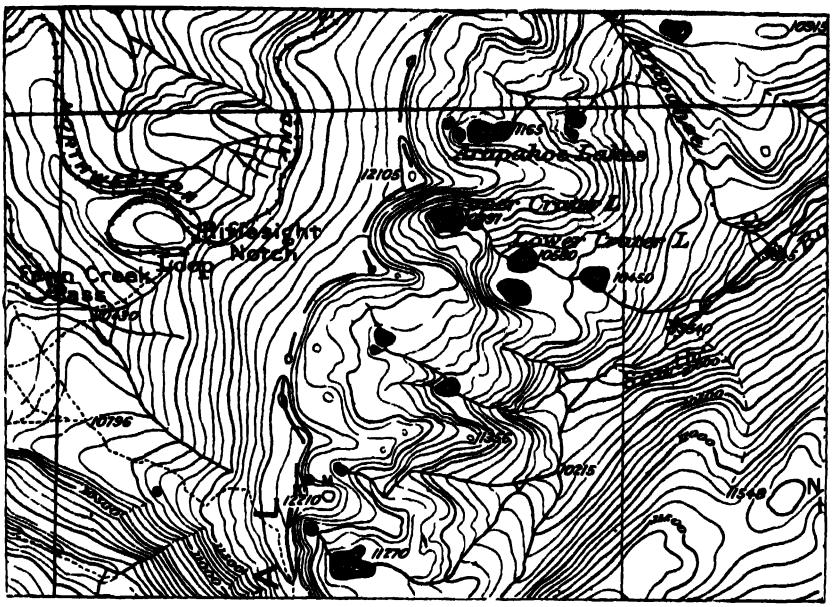


FIG. 9.—SERIES OF SEMICIRCULAR GLACIAL AMPHITHEATRES, WHOSE SCALLOPED CREST FORMS PART OF THE DIVIDE OF THE NORTH AMERICAN CONTINENT. CENTRAL CITY SHEET, TOPOGRAPHICAL ATLAS, U.S. GEOLOGICAL SURVEY.

the deepened and widened valley below (see Plate I., Figs. 1 and 2). Later, with the continuation of the sapping process, the cirque becomes enlarged to such an extent that its sides form recesses in the walls of the valley. Thus, in the plan, the glacial valley of this stage bears some resemblance to that of a nail with a large rounded head.

As the upland is still further dissected, the cirque becomes more irregular in outline and widens into a roughly elliptical form, not infrequently allowing it to be seen that it is in reality composite or made up of several cirques of a lower order of magnitude (Figs. 10–12).

Grooved and Fretted Uplands.—The new emphasis put upon topographic expression of character in the maps issued by Government

bureaus during the past few years, has furnished physiographers a tool of which they are hardly yet fully aware. Before, the aim of topographers seemed to be to suppress all character through a rounding off of angles and an averaging of the data. Perhaps nowhere has the change been more noteworthy than in the maps issued by the United States Geological Survey,* and the later sheets particularly, when relating to glaciated mountain districts, afford us the opportunity of tracing the successive steps in the dissection of such upland districts by the cirques of mountain glaciers. For Plate I. four areas have been selected to represent successive stages in such a progressive dissection.

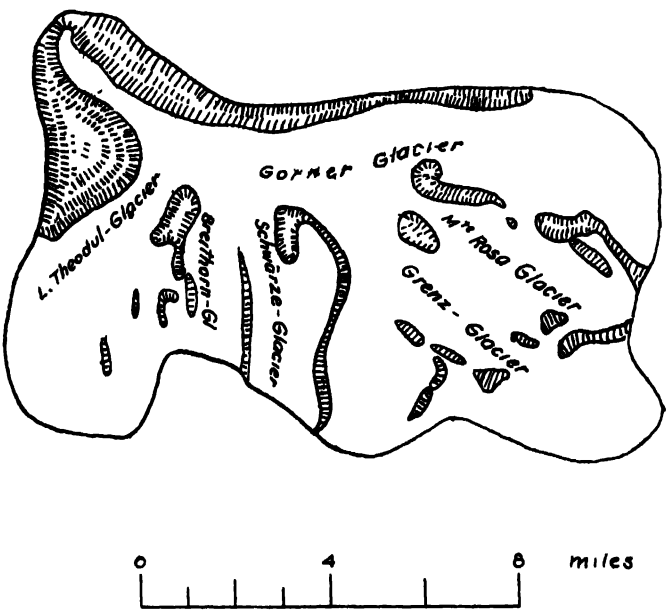


FIG. 10.—OUTLINE PLAN OF ONE OF THE ELLIPTICAL MINOR CIRQUES AT THE HEAD OF THE NICOLAI VALLEY, SWITZERLAND.

An early product in which large remnants of the upland surface still remain, may well be designated a *grooved* or *channelled* surface (see Fig. 13 (*a*)).

As the hemicycle advances, it will be observed that on the flanks of the range are found the largest remnants of the original upland surface (see Fig. 14),† owing to the tendency of the cirque to push

* See D. W. Johnson and F. E. Matthes, 'The Relation of Geology to Topography.' Reprint from Breed and Hosmer's 'Principles and Practice of Surveying,' chap. vii. Wiley & Co., N.Y., 1908

† Other quadrangles of the U.S. Geological Survey which display the upland surface more or less completely dissected by mountain glaciers are the following: *Early stage*: Younts peak (Wyoming), Marsh peak (Utah-Wyoming), and Georgetown



FIG 12.—MULTIPLE CIRQUE OF THE DAWSON GLACIER, HAVING A MAJOR SUBDIVISION INTO HALVES WHICH ENCLOSE RESPECTIVELY THE DAWSON AND THE DONKIN NEVES. THE VIEW IS FROM THE ASULKAN PASS, SELKIRK MOUNTAINS

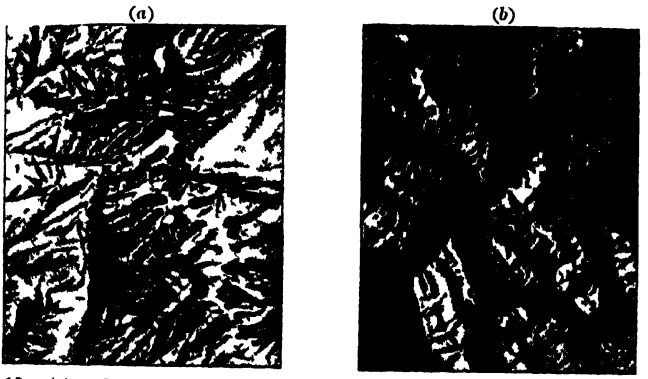


FIG 13. (*a*) A GROOVED UPLAND IN THE BIGHORN MOUNTAINS, WYOMING. (*b*) A FRETTED UPLAND, ALASKA



FIG 14.—



FIG 15 FRETTED UPLAND OF THE ALPS AS SEEN LOOKING NORTH-EASTWARD FROM THE SUMMIT OF MONT BLANC, JULY 25, 1908. THE CIRQUE TO THE LEFT IS THAT OF THE GLACIER DE TALÈFRE, WITH THE JARDIN IN ITS CENTRE, AND DISTANT ABOUT 10 MILES. BOUNDING THIS TO THE LEFT ARE THE ALGUILLE DU MOINE AND THE AIG. VLRTE; AT THE REAR ARE THE AIG. LES DROITES AND LES COURTES; AT THE RIGHT IS THE AIG. DE TRIOLET; AND TO THE FRONT THE AIG. DE TALÈFRE, AIG. DE L'EBOULEMENT, AND AIG. DE LESCHAUX.

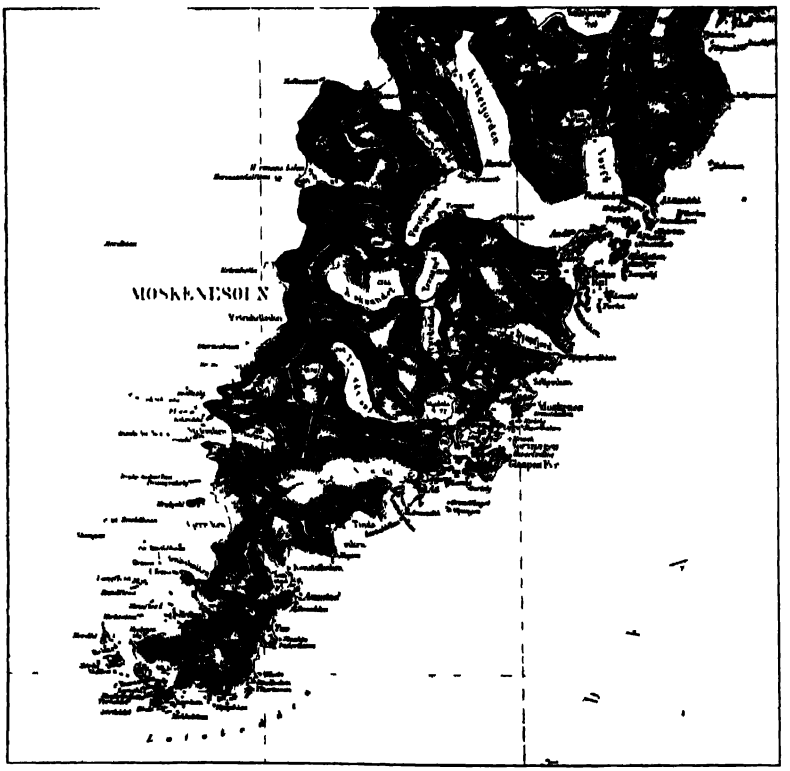


FIG. 16.—MAP OF A PORTION OF ONE OF THE LOFOTEN ISLANDS, SHOWING A FRETTED SURFACE PARTIALLY SUBMERGED AND EMPHASIZING THE APPROXIMATE ACCORDANCE OF SUMMIT LEVELS.

its side walls out beyond the limits of the U-shaped valley below. With complete dissection of the plateau no tabular remnants are to be discovered. The general level of the district has now been lowered, but above this irregular surface project one or more narrow pinnacle ridges, which at fairly regular intervals throw off lateral palisades having crests which fall away in altitude as they recede from the trunk ridge. In general terms, and describing the major features only, we have here to do with a gently domed surface, on which is a fretwork of comb-like ridges projecting above it. This surface may be designated a *fretted upland* (see Fig. 13 (*b*)). Such a condition is realized in the Alps, and is seen to special advantage from the summit of Mont Blanc (see Fig. 15).

The transition from the grooved to the fretted upland is well brought out in two views taken by Lawson in the High Sierras of California (*loc. cit.*, Plate 45, A and B). The fretted upland differs from the grooved upland of an earlier stage of the cycle in the complete dissection of the surface. The character of the fretted surface is well brought out by the topography of the Lofoten Islands off the arctic coast of Norway, where the effect is somewhat heightened through the submergence and consequent obliteration of the irregularities in the floor (see Fig. 16).

At this stage there is undoubtedly a general accordance of level in the crests of the frets upon the domed surface, as Daly, taking due account of the cirque-cutting process, has claimed.* Moreover, the existence of such a series of frets as are to be found in the Alps, forces us to conclude that such an accordance of summits persists for a considerable time. Were this not the case, we should find a larger number of low cols and a longer persistence of the semicircular form of the cirque. It seems probable, therefore, that a very definite relationship obtains between the plan of the cirque and that of the near-lying upland remnants that contribute snow to its basin. So soon as cirques approach from opposite sides of a divide, the portions of their basins which are more nearly adjacent receive less snow, and, in consequence, accomplish less sapping than the walls on either side where snow is lodged in a quantity but slightly diminished. This self-regulating process will tend to broaden the cirque and eventually give it irregularities of outline dependent primarily upon the initial positions and the individual nourishments of its near-lying neighbours.

Characteristic Relief Forms of the Fretted Upland.—In the earlier stages of mountain glaciation the upland is channelled by valleys U-shaped in

(Colorado); *partial dissection*: Mount Lyell and Mount Whitney (California), Grand Teton (Wyoming), Gilbert peak and Hayden peak (Utah-Wyoming), and Silverton and Anthracite (Colorado); *complete maturity*: Kintla Lakes (Montana).

* R. A. Daly, "The Accordance of Summit Levels among Alpine Mountains: the Fact and its Significance," *Jour. Geol.*, vol. 13, 1905, pp. 117–120.

their upper stretches, and somewhat broadened into steep-walled amphitheatres at their heads. With the complete dissection of the upland, the coalescence of the many cirques at last cuts away every remnant of the original surface and yields relief-forms which are dependent mainly, as already stated, upon the initial positions of the cirques.*

If there be a highest area within the upland, the snow will be carried farthest from it by the wind, and this will be in consequence the last to succumb to the cirque-cutting process. The dome of Mont Blanc in the midst of a forest of pinnacles, no doubt owes its peculiar form to the fact that it dominated the pre-Glacial upland. Elsewhere

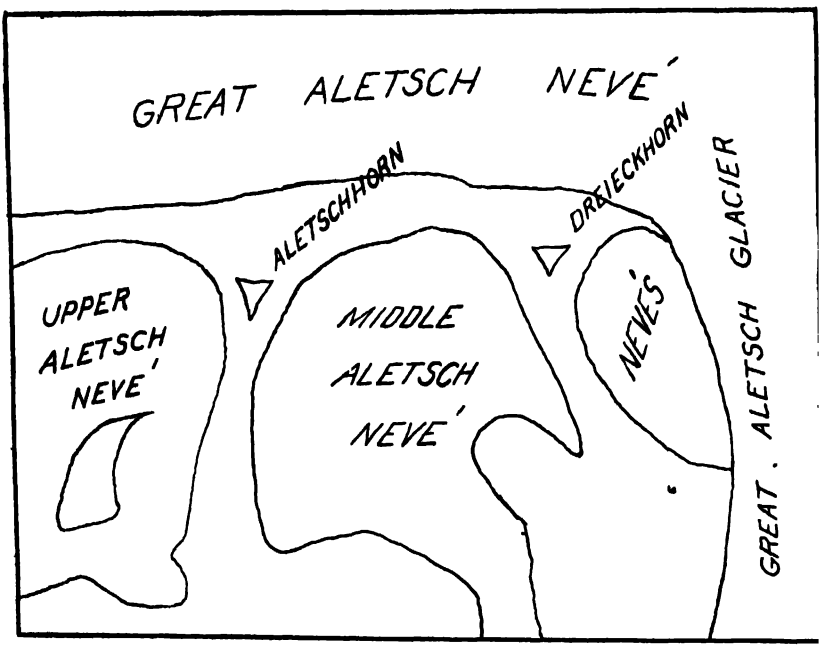


FIG. 17.—POSITION OF THE ALETSCH- AND DREIECKHORNS BETWEEN THE UPPER, MIDDLE, AND GREAT ALETSCH NÉVÉS.

within the upland the coalescence of cirques has produced comb-like palisades of sharp rock-needles which have long constituted the *aiguille*

* The analogy with the forms produced by etching upon crystal faces is so striking that it may be helpful to note it in comparison. The first effect of a reagent in its attack upon the plane of a crystal face is the excavation of deep pits which have a similar and wholly characteristic form, though the surface in other places remains unchanged. These pittings later increase in number, as they do in size, and eventually they mutually coalesce, destroying utterly the original plane surface, and leaving in relief a series of hills and ridges (etch-hills) projecting above a somewhat irregular floor, whose average level is a measure of the average depth of the excavations made by the process. The noteworthy difference between this process and that of cirque recession in glaciated uplands is that the glacial etch-figures are relatively longer and narrower.

type of mountain ridge. In the literature of physiography, such ridges have perhaps most frequently been designated by the term *arête* (fish-bone), though in the Alps the term *grat** (edge) has been applied especially to the smaller and lateral ridges of this type. I propose to use for all such palisades of needles derived by this process the name comb-ridge† as the best English term available. The frequent occurrence of lateral arms joined to the main palisade of needles suggests a differentiation into main and lateral comb-ridges.

In every mountain district maturely dissected by glaciers, are to be found sharp horns of larger base and especially of higher altitude than the individual minaret-like teeth of the comb-ridges. They are further in contrast with the latter by having an approximately pyramidal form, and a base most frequently a triangle with flatly incurving sides. They appear most frequently at the junction points of the comb-ridges between three or more important snow-fields (see Fig. 17). Such forms are generally termed *horns* in the Alps, and the word being of the same form in English, it may well be retained as a technical expression. The Matterhorn in Switzerland is the type *par excellence* (see Fig. 18), though similar and almost equally striking examples are numerous, as, for example, the Weisshorn and Gross Glockner in the Alps, Mount Assiniboine in the Canadian Rockies, or Mount Sir Donald in the Selkirks. The triangular base and pyramidal form are so common to this feature that they have found expression in the local names, as Dreieckhorn, Deltaform peak, etc.

The Col and its Significance.—The prominent horns of any glaciated mountain district no doubt occupy positions corresponding in the main to the more elevated areas in the original upland surface, since such positions would be earliest cleared of snow, and hence latest attacked by the cirques. After complete dissection of the upland the comb-ridges which fret its surface will be attacked from opposite sides, and their crests will be first lowered at the points of tangency of the adjacent cirques—generally near the middle points of their curving outlines. The sky-line of the ridge will thus be lowered in a beautiful curve forming a pass or *col*. Inasmuch as the cirque approaches in its form an inverted and truncated cone of acuminated type, the curve to which the rim of the col approximates will be furnished by the intersection of two cones of revolution with the same apical angle and having parallel axes (see Figs. 19 and 20). This curve is approximately a hyperbola, the

* Very likely originally from *grête*, fish-bone.

† The use of *combe* in the Jura and the Cote d'Or for different types of valley, or of *coombe* in the Southern Uplands of Scotland for a glacial valley, being each essentially local and having further no relation to the toothed article which suggests the name comb-ridge, does not constitute a serious objection to this choice. Mr. Matthes (and possibly others) have already used the expression comb-ridge in the above described sense ('Appalachia,' vol. 10, 1904, p. 260).

eccentricity of which will be largely dependent upon the relative sizes of the two cirques in question.

The corries of the Scottish Highlands, being generally of small size, have coalesced to produce a very characteristic scalloping of the horizon line seen to advantage in Ben Nevis, or, better still, in the sculptured gabbro of the Cuchulin hills in Skye.* To judge from views, also, such forms are found in North Wales, features which in many respects are different from those found in the Alps or in the North American mountains.†

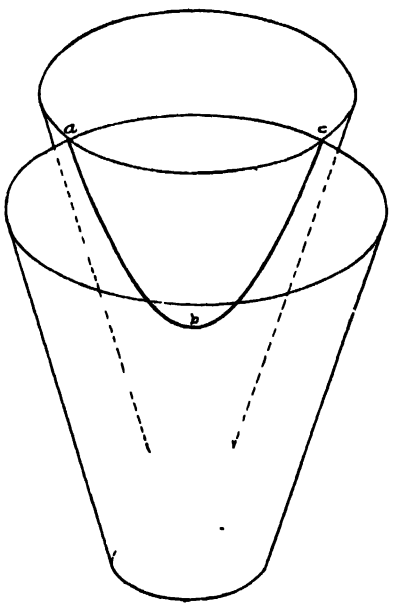


FIG. 19.—ILLUSTRATION OF THE FORMATION OF COLS THROUGH THE INTERSECTION OF CIRQUES

It must be regarded as of deep significance that mountain passes in areas which have supported glaciers are so generally at high levels. Deep glacier-cut valleys available as highways and transecting high ranges are extremely rare; so far as the writer is aware, being known only from the Southern Andes‡ and Alaska.§ This fact must have its explanation, it is believed, in a notable and abrupt retardation in the rate of cirque-wall recession, following close upon the dissection of the upland. Whether this is due to the reduced snow accumulation immediately beneath the cirque wall owing to the lack of a near-lying collecting ground, it is as yet too early to say; but a comparison of the acclivities in the marginal snow-slopes on *névés* of the Bighorn and Alaskan districts might yield an answer to the question.

Though the sapping process at the base of cirque walls up to maturity is doubtless far more potent than abrasion and plucking upon the floor of the amphitheatre, it seems likely that in the subsequent stage the reverse is the case. This would at least explain the tendency

* See Harker, "Glaciated Valley of the Cuchulins, Skye," *Geol. Mag.* (Fig. 4), vol. 6, 1899, p 197; also "Ice Erosion in the Cuillin Hills, Skye," *Trans. Roy. Soc. Edinb.*, vol 40, 1901-1902, pp 234-237.

† This characteristic form of cirque, partly open at the head, is well brought out in a view published by Sir Andrew Ramsey as early as 1852 (*Quart. Jour. Geol. Soc.*, vol. 8, p. 375).

‡ 'Argentine-Chilian Boundary in the Cordillera de los Andes.' 5 vols

§ R. S. Tarr, "Glaciers and Glaciation of Yakutat Bay, Alaska," *Bull. Am. Geogr. Soc*, vol. 38, 1906, p. 149.



FIG. 18. —THE MATTERHORN FROM THE GORNER GRAT, NEAR THE RIFFELHORN.



FIG. 20.—COL OF THE OVERLOOK LOOKING ACROSS THE FOOT OF THE ILLECILLE-WAET GLACIER, SELKIRKS.

of glacier valleys to deepen rapidly in the higher altitudes, or, in Johnson's phrase, to get "down at the heel."

The Advancing Hemi-cycle.—With the augmentation of rigorous climatic conditions within any district where glaciers already exist, the latter will be continually more amply nourished, and must in consequence increase steadily in size. Such climatic changes may even be conceived so considerable that at last the entire range is submerged beneath snow and ice, thus producing an ice-cap.

Direct observation of the successive stages through which glaciers pass from their initiation to their culmination in an ice-cap, is of course impossible, for the reason that we live in a receding hemi-cycle in which practically all known glaciers, instead of expanding, are drawing in their margins; yet a synthetical reconstruction of the life-history is none the less possible. To employ an illustration already used in a different connection, in order to learn the life-history of a particular species of forest tree, it would not be necessary to sit down and observe an individual tree from the germination of its seed to the decadence of the full-grown tree. We may with equal profit go into the forest and observe trees of the same species in all stages of development. In the study of glaciers our opportunity is hardly so fortunate as this, for, as already stated, all glaciers appear to be in the declining stage, whereas it is the advancing hemi-cycle with which we are now concerned. The characters of glaciers as concerns their size and shape depend, however, in so large a measure upon the one element of alimentation, that if we neglect characters of a second order of magnitude, we may by inference construct the history with sufficient accuracy from existing examples.

(*To be continued.*)

SURVEY WORK ON THE BOLIVIA-BRAZIL BOUNDARY.

By Major P. H. FAWCETT, R.A., Chief Bolivian Commissioner.

THE Bolivian Boundary Commission continued its labours in 1909, completing the delimitation of the eastern boundary over the ground explored during the latter half of 1906. A sketch of that exploration, together with a *résumé* of the work already completed, was published in the *Journal* of the Society early in 1909.

The repetition of the work was rendered necessary by the unwillingness of the Brazilian commissioner, partly for political reasons and partly owing to the risks entailed in the breaking of unknown country, to join in an exploration which would have completed in one year of work a delimitation for which seven years had been anticipated. As I think I mentioned in the communication referred to, the party of exploration were speeded from Corumba to the utmost limits of civilization

at the old city of Matto Grosso by the expressed conviction that it would never return. In truth, its experiences were not very delectable. Of the six peons who accompanied Mr. Fisher and myself and ultimately struggled back to civilization, five died of the effects. I encountered the survivor, curiously enough a prisoner like myself amongst the Paraguayan revolutionaries, in September last year, and it says much for his pluck that he was willing to repeat the journey. Of actual work there remained little to do. In any case, it is the journey which demands so much in these regions.

A general strike of the entire working population in Buenos Aires in April delayed departure. On my arrival in Corumba the Brazilian Commission was already leaving for the north. After over three weeks spent in the collection of peons and animals, and not twelve hours after the departure of the commission in the wake of the Brazilians, the lighter carrying twenty-nine mules and oxen went to the bottom. Not a single animal survived. I proceeded, however, on the chance of picking up transport amongst the small ranches *en route*, and fortune so far favoured us as to provide, at a price, seven mules, whilst one of the most beautiful mules I have ever seen, ownerless, a simple God-send, walked into a mid-day camp.

We came up with the Brazilians in the old city of Matto Grosso. They had found that the most liberal arrangements could not ensure them a bed of roses, and were waiting in the old city, somewhat uncertain how to proceed. They were fortified with the plans and information of our previous expedition. In the end I took ten Brazilian animals loaded with provisions, some soldiers, and an official, Commandante Lamiña, with my own party direct to the source of the Verde, across the hills of Ricardo Franco. In the previous year we had occupied three weeks of a foodless journey without animals over the exit from the source of the Verde to Matto Grosso by another route; and an International Commission of 1878 had recorded the hills as impassable. It is indeed a route exceedingly complicated, owing to the network of gorges which intersect the sandstone plateau in every direction. The eighteen days occupied by the journey were, I think, amply sufficient for our companions. Meanwhile the Brazilian technical party had left Matto Grosso under the capable direction of Commandante Frederico Oliveira, an experienced Brazilian explorer, following our route of 1908 *viâ* the confluence of the rivers Verde and Guapore.

We reached the source of the Verde on August 10, losing two animals *en route*, it being necessary to overload our own mules in order to help out the Brazilians, who had only donkeys, and whose supplies were important to their main party.

Once at the source, the work was completed in a week. An affluent was discovered which carries the source a trifle further eastward than the position determined in 1908; otherwise, the old work holds good.

The geographical co-ordinates of this region are as under. Matto Grosso, the longitude of which was determined telegraphically from Rio Janeiro by the Brazilian Telegraph Commission, comes within 24″ of arc of that found by me in 1908; and the source of the Verde has been referred to it by triangulation.

Matto Grosso	Lat. 15 0 28 S.	Long. 59 57 6
Confluence of the rivers Verde and Guapore ...	Lat. 14 0 2·8	Long. 60 24 16
Source of the Verde	Lat. 14 37 15 2	Long. 60 13 56·2

I had hoped to cross eastwards from the source of the Verde to the hills of the Parecis, traversing that region and returning south by one of the numerous affluents of the Paraguay which flow from that obscure section. All my six peons, however, struck. The Brazilian soldiers had developed scares of savages and filled them with fears. Bribery or cajolement were equally ineffectual. Harsh measures were useless, for they would simply have vanished.

I therefore returned to Matto Grosso, leaving the Brazilians to await the party ascending the river. The return journey only occupied five days—five days of bitter cold, 5° C., with a southerly wind and heavy rain, buried in cloud so dense that 20 yards away an animal was invisible. It was necessary to navigate the plateau, where there is only one route possible for animals, by compass and the plan constructed on the outward journey. At Matto Grosso I found that the Brazilian northern party had suffered misfortunes. The 1908 journey, whose difficulties had certainly been discredited as travellers' exaggeration, was found to be more real than had been expected. The party had been necessarily on foot, carrying all food and instruments on their backs. Commandante Frederico Oliveira himself, whose opinion of the Verde is now strong, had the bad luck to fall into the river in one of the rough gorges, and was forced to return sick with a portion of his escort to Matto Grosso. Two lieutenants, a doctor, and a few soldiers continued the journey without instruments. What their after-experiences were I do not know. They returned to Matto Grosso city, I believe, on September 10, after a journey of nearly two months. Meanwhile my peons culminated their association with the Commission by robbing it of the entire food-supply; and as Matto Grosso is not a city of desirable residence, I left as soon as possible for the river Paraguay. At San Luiz de Caceres we were upset in mid-river crossing the Paraguay, and by sheer intervention of Providence escaped a tragedy.

I ultimately reached Corumba on September 4. Here plans were completed, and delimitation matters arranged with the head of the Brazilian Commission, who had remained in that city; arrangements being the more simple as the Brazilian Commission had the bad luck to have been unable to get any observations in the Verde, and relations

between the two Commissions had always been of the most cordial nature. The courtesy and experience of the Brazilian commissioner, Admiral Guillobel, and his able staff need no testimony from me. Their work is written on forty years of boundary delimitation. In the valley of the Paraguay 1909 was an exceptionally dry year, hampering the navigation of the river. On September 20 we left Corumba in a small tug for Assuncion, were captured by revolutionaries, and ultimately reached Buenos Aires on October 11, and La Paz on November 9.

At the request of the Government, I have undertaken to explore and delimit the new frontier with Peru, which in the region of the river Heath is still unknown, and to complete the delimitation of the frontier in the Acre, which I explored in 1906 and 1907.

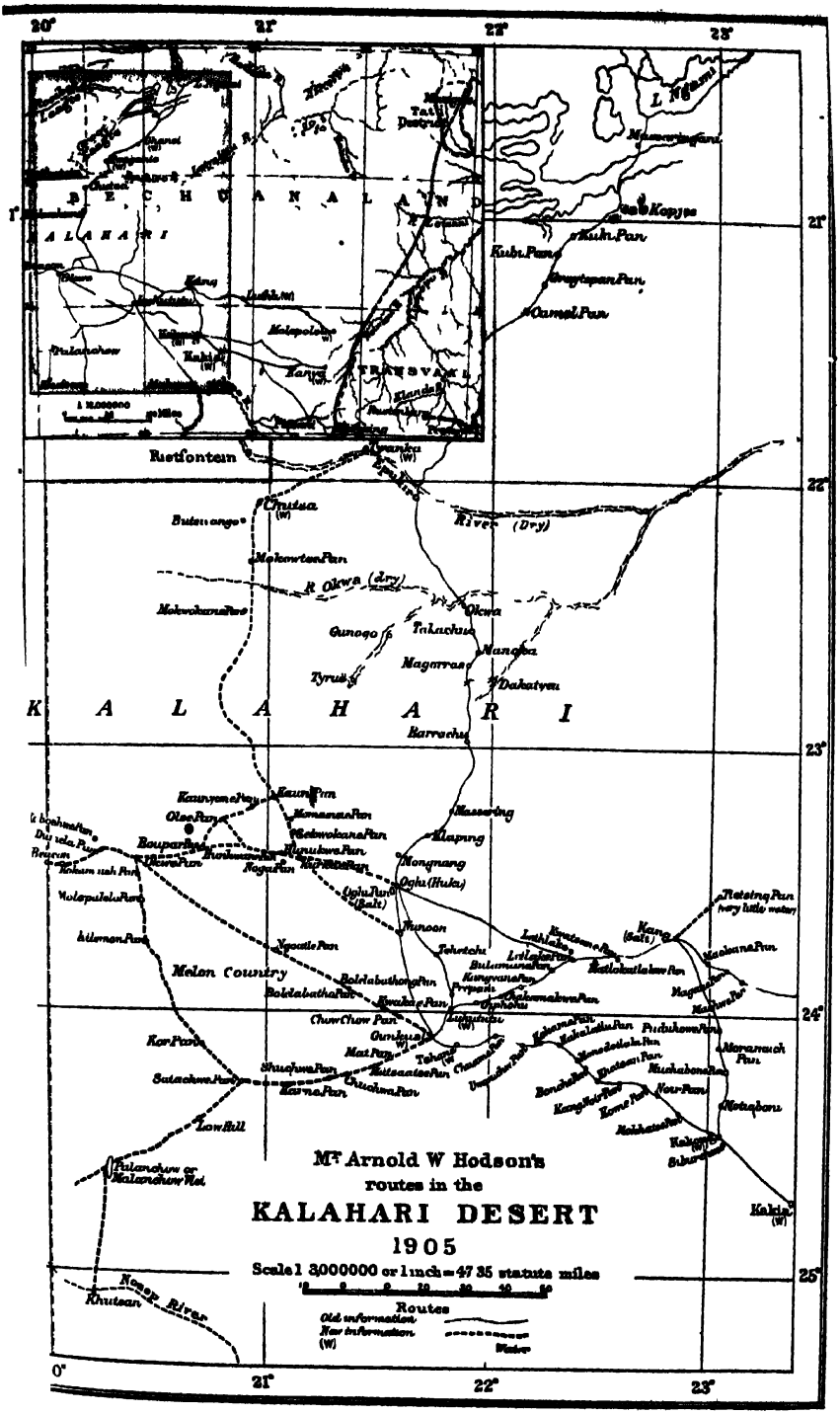
The exploration of the Heath promises to be interesting. It is the happy hunting-ground of the Guarayo Indians, the most hostile and warlike tribe in South America, for which reason it has remained unexplored from a short distance up from its confluence with the Madre de Dios. The Government has considerately agreed to the employment of six ex-soldiers of the British army, in order to minimize the risks and avoid the danger of abandonment by locally contracted peons and Indians in tight places. There will be lucrative employment for them in Bolivia after the work. The Government, moreover, have been so appreciative of the work done as to have commissioned me to arrange for the temporary services of two more British officers for geographical exploration.

I sincerely trust that this little wedge of amity will be followed up. The march of development in Bolivia has been very rapid in recent years. The days of revolutions are past, and no credence must be placed in mischievous exaggerations, such as were cabled from La Paz over the Argentine arbitration award. The country is interesting from any point of view, its officials are broad-minded, and its people most hospitable. I do not hesitate to assert that the country is entering upon an era of most remarkable prosperity.

NOTES ON JOURNEYS TAKEN IN THE KALAHARI DESERT.

By ARNOLD W. HODSON.

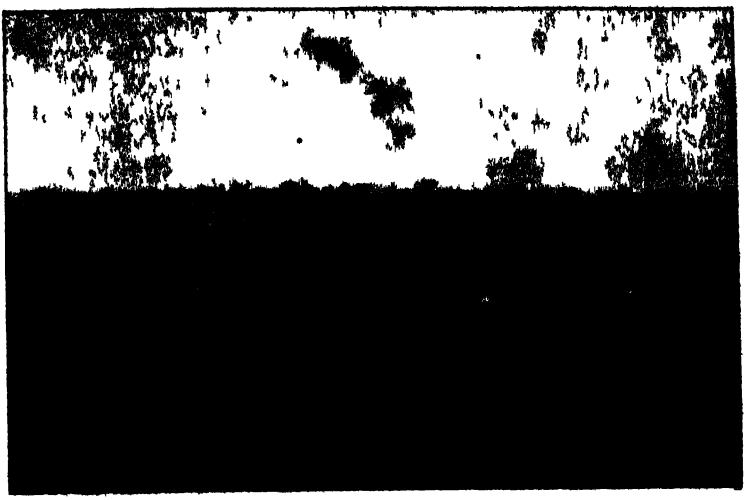
The two chief places from which expeditions, as a rule, start into the Kalahari desert are Molepolole and Kanya. The former is the capital of the Bakwena reserve, and the latter of the Bangwaketse. There are two well-beaten roads from these two places to Lehututu, a place lying about 300 miles west, far into the Kalahari. The country between Lehututu and the German border is practically unknown, and when I first went into it it was shown as a blank on the map. I intend, therefore, to give a short account of the roads from Molepolole and


20°
21°
22°
23°
BECHUANALAND
ALALHARI
TRANSVAAL
Rustfontein
Kuke Pan
Kamel Pan
Kopjes
Lake Ngami
Mamuncingani
Chuntsa
Butsumango
Makowtsen Pan
R. Okwa (dry)
Okwa
Gunogo
Tulucha
Mangwa
Magurrae
Tyrus
Dakatwa
Barrochu
River (Dry)
KALAHARI
Kaurya
Kaun Pan
Olse Pan
Monanwa Pan
Makowkana Pan
Maping
Mosetwing
Mongnang
Ogha (Huka)
Nuncon
Tshotshi
Melon Country
Boldabatha Pan
Chow Chow Pan
Gundusa
Mat Pan
Tutsaatse Pan
Shushwa Pan
Chuchwa Pan
Kar Pan
Satachwa Pan
Low Hill
Tulanchaw or Malanchaw Rd.
Nosop River
Khutsan
Kang
Ludila (W)
Molopolole
Kolobeng
Kanye
Mochudi
Ramathlabama
Pilanesberg
Zeerust
Lichtenburg
Potchefstroom
Klerksdorp
Vryburg
Taungs
Kuruman
Griquatown
Prieska
Hopetown
Boshof
Bloemfontein
Thaba Nchu
Ladybrand
Wepener
Aliwal North
Zastron
Basutoland
Harrismith
Bethlehem
Ficksburg
Kroonstad
Heilbron
Parys
Vereeniging
Johannesburg
Pretoria
Rustenburg
Zeerust
Mafeking
Lobatsi
Gaberones
Palapye Road
Serowe
Francistown
Tati District
Selibi Phikwe
Shashe
Limpopo
Notwane
Crocodile
Marico
Molopo
Nossob
Auob
Kuruman
Hygropan Pan
Kuhn Pan
Ramathlabama
Kang
Ludila (W)
Molopolole
Kolobeng
Mochudi
Kanye
Pilanesberg
Zeerust
Lichtenburg
Potchefstroom
Klerksdorp
Vryburg
Taungs
Kuruman
Griquatown
Prieska
Hopetown
Boshof
Bloemfontein
Thaba Nchu
Ladybrand
Wepener
Aliwal North
Zastron
Basutoland
Harrismith
Bethlehem
Ficksburg
Kroonstad
Heilbron
Parys
Vereeniging
Johannesburg
Pretoria
Rustenburg
Zeerust
Mafeking
Lobatsi
Gaberones
Palapye Road
Serowe
Francistown
Tati District
Selibi Phikwe
Shashe
Limpopo
Notwane
Crocodile
Marico
Molopo
Nossob
Auob
Kuruman
Hygropan Pan
Kuhn Pan
Camel Pan
Kopjes
Lake Ngami
Mamuncingani
Chuntsa
Butsumango
Makowtsen Pan
R. Okwa (dry)
Okwa
Gunogo
Tulucha
Mangwa
Magurrae
Tyrus
Dakatwa
Barrochu
River (Dry)
KALAHARI
Kaurya
Kaun Pan
Olse Pan
Monanwa Pan
Makowkana Pan
Maping
Mosetwing
Mongnang
Ogha (Huka)
Nuncon
Tshotshi
Melon Country
Boldabatha Pan
Chow Chow Pan
Gundusa
Mat Pan
Tutsaatse Pan
Shushwa Pan
Chuchwa Pan
Kar Pan
Satachwa Pan
Low Hill
Tulanchaw or Malanchaw Rd.
Nosop River
Khutsan
Retsing Pan very little water
Kang (Salt)
Kakia (W)
Mr Arnold W Hodson's
routes in the
KALAHARI DESERT
1905
Scale 1 3000000 or 1 inch = 47 35 statute miles
Routes
Old information
New information
(W) Water
0°
21°
22°
23°
24°
25°

Kanya to Lehututu, and a more detailed account of the country lying to the west of it, with a rough sketch showing the places I touched in my wanderings.

On the Kanya road there is water in pits at Sevrelela, Kooi, Sekgoma, and Kakia. From Kakia there is a very long thirst (or dry stretch) to Lehututu, the distance being about 110 miles. These long thirsts are accomplished with a bullock waggon in the following manner. It is difficult to lay down a hard-and-fast rule, as so much depends on the condition of the bullocks, the time of the year, etc. I have always found it the best plan to trek out about 20 miles, outspan, and send the bullocks back to water, letting them rest there a couple of days. The bullocks would then be driven out to the waggon again and inspanned. We would then travel for two nights, when we should be about 20 miles from Lehututu. The bullocks would then be sent on to get a drink and a rest, and after that would be driven back to draw the waggon in. All travelling in the desert is done at night, and the water for one's consumption is carried in barrels under the waggon.

There are a great many pans all along this road, and in the rainy season most of them hold water, so that then travelling is quite an easy matter. These pans are very peculiar. They are all open and quite flat, and perfectly white. I noticed that most of them had a slight rise at their southern extremities. Very often on approaching them you would think they were full of water, the result of the mirage. On the Molepolole road there is water at Metsematluk, Luttli, and brack water at Kang. This road is not so good as the Kanye one, the distances between the wells being greater, to say nothing of the brack water at Kang. The country between Kanye and Kakong consists chiefly of large open plains, on which beautiful grasses flourish, but from Kakong to Lehututu it is thickly wooded, and these woods continue due west right to the German border. The border is the 20th degree of longitude, and is marked at intervals by iron beacons which are numbered, and have the German emblem on one side and the British on the other. The country lying between Lehututu and Damaraland is quite waterless, except, of course, in the rainy season, and one has therefore to depend entirely on melons as a substitute. There are two kinds of melons: one is cultivated, and is called mekatan, and the other grows wild, and is known as kganwe; and of the latter there are two varieties, exactly alike in appearance, but one tasteless and the other bitter like quinine. Animals can eat both, but human beings only the former. There is no way to tell which is which except by tasting. The best way to prepare them is to cut them into slices and boil them in a pot. When they are boiled in this way they give forth a certain amount of liquid, with which you can make coffee or tea. If there is no pot, you cut off their tops and stamp the inside into a pulp, which can then be eaten, and to which the addition of a little sugar is a great improvement.



KAKIA PAN



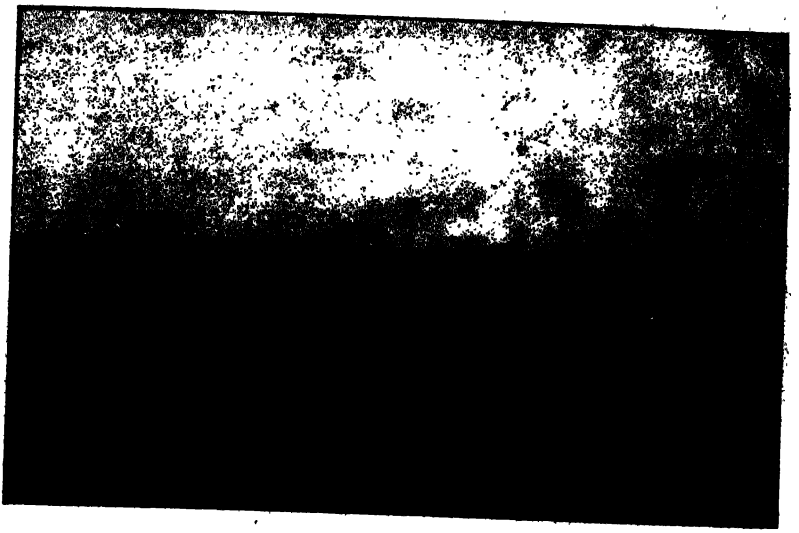
KALAHARIS WITH MELONS.

As one travels south-west of Lehututu the country alters completely. It is composed of row after row of sand-dunes, which extend right to the Nosop river. This river, at the point I touched, was just a dry bed with trees growing in the middle of it. These sand-dunes rather give one the impression of the sea on a rough day. This part of the Kalahari is chiefly occupied by the Hottentots, who, accompanied by their cattle and goats, follow the wild melon about from patch to patch. I rode through from Kaun to Choutsa, crossing the Oken river *en route;* this, again, is only a river in name, being quite dry. This was a long and difficult thirst, as we found no melons or water till we reached Choutsa. From Choutsa to Lake Ngami the road offers no difficulties, as there is water in wells at frequent intervals. The principal natives living on the Kalahari are the Mokalahari and the Masarwa. There are also a few Baralongs, etc., living at Lehututu, and a certain number of refugee Damaras. The Mokalaharis are, as a rule, servants to the different Bechuana tribes. They are finely built, but stupid, and seem to have no cares in life so long as they can get milk and an occasional taste of meat. They live in small villages close to the wells, or else out on the melon patches. They look after the Bechuanas' cattle and collect skins, ostrich feathers, etc., for them.

The Masarwas (bushmen) are again subject to the Mokalaharis. They have no fixed habitations, but roam about after the large game, on which they practically live. They are wonderfully clever at trapping the smaller animals, the skins of which they hand over to their masters, the Mokalaharis. They have many strange customs and cures, one of the most peculiar of the latter being, I think, the snake-bite cure. It is made from a small lizard, which they kill and dry. If any one is bitten, they grind a little of this reptile up into powder. They then make two incisions above and below the wound and rub the powder in. The patient also drinks a very little of the powder mixed up in water, and the cure is complete. I have known two bushmen bitten by deadly snakes who used this cure, and on each occasion recovered. Some of them cut open the snake that has bitten them and swallow certain parts of its inside, which they also say acts as a cure. The Masarwa are in appearance slightly built, and have very small hands and feet. Their abdomens, however, are very large, doubtless a provision of nature to enable them to eat at one sitting enough to last them for several days.

The following varieties of large game are found in the Kalahari: eland, giraffe, hartebeeste, blue wildebeeste, kudu, gemsbok, ostrich, springbuck, and the smaller antelopes, such as steinbuck and duiker.

I also obtained specimens of the smaller kinds of animals: banded mongoose (*Crossarchus fasciatus*), sepia cat (*Genetta felina*), striped mouse (*Arvicanthis pumilio*), silver fox (*Fennecus chama*), manhaar jackal (*Proteles cristatus*), bushy tail mier cat (*Eliomys Murinus*), squirrel (*Xerus*



CART IN BED OF NOSOP RIVER.



GROUP OF BUSHMEN.

capensis), Cape jumping hare (*Pedetes caffer*), Cape long-eared fox (*Otocyon megalotes*), vaal bushcat (*Felis caffra*), slender mongoose (*Herpestes gracilis*). Besides these there are many other varieties.

To sum up, given plenty of water, the Kalahari desert would be an ideal cattle country, and probably if water were bored for, it would be found at no great depth.

THE NORWEGIAN SEA.*

Before 1876 the explorations dealt with in the Report by Dr. Helland-Hansen and Dr. Nansen had been confined almost entirely to the outskirts of the Norwegian sea, viz. the sea between Scotland and the Færoes, near the east coast of Greenland, the sea between Spitsbergen and Norway, and the sea off the Norwegian coast. The Norwegian sea itself was practically a *mare incognitum* before the Norwegian *Vöringen* Expedition (1876–1878). From this date up to 1900 many expeditions have collected observations within the basin of the Norwegian sea.

There is no doubt that it is to Dr. Hjort's researches that we are indebted for the splendid results arrived at by the explorations of MM. Helland-Hansen and Nansen. Dr. Hjort's studies in the waters along the Norwegian coast in 1893, and carried on in the succeeding years under his supervision, had been extended to the Norwegian sea. The results obtained were of so much importance that they led to the building of a ship, the *Michael Sars*, to study the problems of the Norwegian sea and bearing more or less on the Norwegian fisheries.

In Chapter II. we find a short account of the cruises during the years 1900 to 1904. Most of the observations discussed have been collected during the cruises of the Norwegian Fishery Research steamer *Michael Sars* during the years 1900 to 1904, and during May, 1901, and May, 1902, between Norway and Iceland, on board the *Heimdal*, of the Royal Norwegian Navy. Special attention has been paid to the work at each station, in order to get the best possible series of observations to show the vertical distribution of salinity and temperature at certain selected points. The distance between the stations was 20 miles, or even less. Since 1902 Danish and Scottish oceanographers have made investigations between the North sea and Iceland, and the authors have made use of these observations in connection with their own for the discussion of the special problems of the Norwegian sea.

The third chapter on instruments and methods is very important. In the case of the central part of the Norwegian sea the salinities are between 34·85 per mille and 35·20 per mille. With such a slight total range in the salinity of the various waters, the seasonal and annual variations are still smaller, and to be detected the most accurate methods must be employed. The accuracy required by the International Council for the Study of the Sea is 0·05 per mille of the salinity. It is, in some cases, not sufficient for the variations of the Norwegian sea. If we take the deep strata of the Norwegian sea below 300 fathoms, I quite agree with

---

* 'The Norwegian Sea: its physical oceanography based upon the Norwegian Researches, 1900–1904.' By Björn Helland-Hansen and Fridtjof Nansen. Report on Norwegian Fishery and Marine Investigations. Vol. 2, 1909, No. 2. *With 28 Plates.* Bogtry K. Rerl. Kristiania: Het Mallingske. 1909.

the authors when they write, "The quality of the observations, especially in this deep part of the sea, is of much greater importance than their quantity."

During the first cruises of the *Michael Sars* the deep-sea temperatures were taken with the Negretti and Zambra reversing thermometer, and with the insulated water-bottle. During the latest cruises the observations of the temperature of the deep strata have been made with the new Richter reversing thermometer, that can give an accuracy of ±0·01 C. On the other hand, Nansen made a great improvement on the Pettersson insulated water-bottle by fixing a thermometer in the lid of the water-bottle; it is the so-called "Great Nansen insulated water-bottle" (made by Andersen in Christiania), with a capacity of 5 or 6 litres. The Nansen stop-cock water-bottles have been constructed on the principle of the Buchanan stop-cock water-bottle of the *Challenger* Expedition. Attached to the sounding-line, they were of great help in getting water-samples at intermediate depths, and worked very well.

The preservation of the water-samples is of great importance, and the authors recommend the discontinuance of the use of bottles with corks, and the use instead of indiarubber stoppers when the samples have to be stored for more than two weeks.

The Basin of the Norwegian Sea and its Bathymetrical Features.—The Norwegian sea is the whole sea-area enclosed between Norway, the Shetlands, the Færoes, Iceland, Greenland, Spitsbergen, and Bear island. It is divided into three parts: (1) The Greenland sea, between Northern Greenland (north of 71° lat. N.), Jan Mayen, and Spitsbergen; (2) the Iceland sea, between Iceland, Jan Mayen, Greenland (south of 71° lat. N.), and the Iceland-Greenland submarine ridge; (3) the Denmark strait, being a portion of the latter sea, lying between Iceland and Greenland. The fact that the Norwegian sea is situated between the deep North Polar basin and the Atlantic ocean, *i.e.* in the way of the waters travelling between the two seas, has a fundamental effect on its circulation.

Now let us glance at the bathymetrical features of the Norwegian sea as shown on the beautiful map compiled from the latest sources. The floor of the Norwegian sea is divided into two deep basins, viz. the Norwegian deep and the Greenland deep. The map shows very few soundings in the middle part of the Norwegian deep, and, as stated by the authors, it might be that this basin is divided into two portions by a continuous ridge crossing the Norwegian deep from Jan Mayen to the Helgeland coast in Norway. The Greenland deep is separated from the Norwegian deep by "Mohn's transverse ridge" trending from Jan Mayen to the great submarine valley of the Barents sea. The *Belgica* found a hollow 1700 fathoms deep to the north of the Greenland deep, and separated from the latter by a submarine ridge trending westwards from Prince Charles foreland. The most important feature of the Norwegian sea is the submarine ridge known as the "Wyville-Thomson ridge," extending from Scotland to Greenland through the Færoes and Iceland. The greatest depth recorded on the ridge between Scotland and the Færoe bank is 290 fathoms. The Færoe-Iceland ridge forms a fairly level plateau at depths of 200 to 250 fathoms, with a maximum depth of 260 fathoms. The Iceland-Greenland ridge has a saddle-depth of about 300 fathoms.

General Description of the Water-masses of the Norwegian Sea.—The water of the Norwegian sea may be divided into two layers, viz. a surface layer 200 to 250 fathoms deep, and a bottom layer. There is a striking contrast between the physical characters of these two bodies of water; the surface one is heterogeneous, while the lower one is of remarkable uniformity. We find the explanation of this difference in the geographical position of the Norwegian sea.

The different water-masses in the surface layer are—Atlantic water with high

salinity, above 35 per mille; coast water from the North sea, the Baltic, and the Barents sea, salinity below 35 per mille; central water-masses, formed by the mixture of Atlantic water and Polar water, salinity below 35 per mille.

The bottom water representing the bottom layer fills all the deeper parts of the Norwegian sea. It is of constant salinity (a little above 34·90 per mille), and temperature (−1 C.). Thousands of observations led the authors to this very important conclusion, that can be extended to the ocean in general, that *the density gradually increases from the surface to the bottom.*

Chapter vi. deals with the apparent irregularities in the horizontal distribution of temperature, salinity, and density. The equilines (isothermes, isohalines, as well as isopykrals) form bends or undulations like waves, sometimes great, sometimes small. The study of the exact nature and mode of formation of these "waves" and their movements is of great importance. Helland-Hansen and Nansen cannot solve this problem for the present, but they demonstrate how these "irregularities" may be formed in three different ways—(1) by "waves" of some kind, on the boundary between water-strata of different densities; (2) by sudden variation or direction of the surface currents; (3) by great vortex movements or horizontal movements with vertical axes, as shown by the sections of the Lofoten."

To find the solution of the question, oceanographers will have to follow the advice of the authors, "Take as many stations as possible, with the shortest distances between them, and also—at any rate, at some of the stations—repeat as often as possible the observations from the same depths at different hours of the day and night, in order to find out whether the different strata have changed their level during twelve or twenty-four hours." The determination of the distribution and volume of the different waters in the sea depends mostly on the solution of the "oscillations" problem.

The Norwegian Atlantic Current.—The Norwegian current is formed by the entrance of Atlantic water through two openings, viz. the Færoe-Shetland channel and the opening between the Færoes and Iceland, the deepest part of these submarine ridges being not more than 280 fathoms; if we find "35-water" at greater depths, it must be caused by vertical movements of some kind.

The Atlantic water forms cyclonic or anti-cyclonic vortices that carry the water in directions more or less different to that of the Norwegian current. From the study of the equilines, we can summarize the course and extent of the Norwegian Atlantic current as follows: Where a submarine channel exists in the Færoe-Iceland ridge, we find a "tongue" of water with salinities below 34·90 per mille, moving in a southerly direction. The surface layers are checked by the Atlantic water flowing towards the north-east, while the deeper strata advance further south, and it is possible that they cross the ridge and sink in the deep basin of the Atlantic. The Atlantic water immediately to the east of the cold tongue trends for some time in a northerly direction, then is deflected sharply to the east. It passes to the north of the Færoes, and runs into the Færoe-Shetland channel close along the slope of the Færoe platform. The Atlantic water immediately to the west of the "tongue" moves in an anti-cyclonic direction. Along the southern coast of Iceland we find it with a westerly movement.

The main portion of the Norwegian-Atlantic current enters the southern part of the Færoe Shetland channel having a north-easterly direction. It generally keeps to the Shetland bank. Then in the southern part of the Norwegian sea the Atlantic current is made up of water that has come both from the south and the north of the Færoes.

In the Norwegian sea the main body of the Atlantic current keeps close to the continental slope. The western part of it meets the East Iceland Arctic current,

and forms a cyclone in the southern half of the Norwegian sea at from 65° to 66° N. lat. and from 0° to 4° W. long.

Water from the Atlantic current covers the bottom of the deeper hollows and submarine fjords of the continental shelf off western Norway. This Atlantic water (35 per mille salinity) in the fjords and over the continental shelf is always covered by coastal water.

Let us now consider the outflows from the Norwegian sea-basin. (1) The opening between Norway and Bear island, where the water of the North Cape current, eastern branch of the Atlantic current, runs into the Barents sea, either to come back again to the Norwegian sea south of Spitsbergen, or to enter the North Polar basin to return with the East Greenland Polar current. (2) The opening between Spitsbergen and Greenland, that allows the Spitsbergen Atlantic current, the northern branch of the Atlantic current, to enter the North Polar basin. (3) The opening between Iceland and Greenland, through which the main outflow finds its way across the Iceland-Greenland ridge. (4) The opening between the Faroes and Iceland. Only the first two outflows contain a small quantity of Atlantic water, with salinities above 35·00 per mille, proving that the greater part of the Atlantic water entering the Norwegian sea is changed within this sea-area by admixture with other waters.

The surface velocities of the Atlantic current in the eastern part of the Faroe-Shetland channel are of 30 cm.-sec. in May and about 20 cm.-sec. in August, these figures showing a maximum velocity of the current in spring and a minimum in autumn. At 50 or 100 fathoms the velocity is as great as at the surface. The velocity decreases generally from 150 fathoms, down to 200–350 fathoms where the velocity reaches zero.

The investigations of the annual (or secular) variations of the Norwegian-Atlantic current have led the authors to the following conclusions:—

1. "Observations of the mean temperature of the Atlantic water, in the southern Norwegian sea at the surface, as well as in the deeper layers, afford a method of predicting, several months or more, in advance: the anomaly of the air-temperature in Norway, the prospects of the Lofoten fisheries (whether they come early or late), the growth of the fir-wood, the agricultural prospects, and probably also the growth and spawning of the food-fishes, which again determine the fisheries several years later.

2. "Some prognosis of this kind may be based on meteorological observations, but a much greater number of observations, distributed over a large area, would be required, and the mean of even a huge observation-material of this kind would give no more trustworthy prognosis.

3. "The thermal conditions of the Atlantic water are partly of primary, partly of secondary nature, as compared with the thermal conditions of the air in Norway. The conditions under the surface are chiefly primary; they determine the anomaly of the air temperature of Norway, especially in the winter and spring, because different quantities of heat are given off to the atmosphere by the vertical circulation of the water-strata during the cold season. The thermal conditions of the air (and its moisture amount of clouds, etc.) influence the surface temperature of the sea, which so far is secondary. In this manner we find that a *low temperature*, or rather a comparatively *small quantity* of heat, contained in the layers of the Atlantic water *below* the surface should, as a rule, be followed by a low temperature at the surface the following year, and *vice versâ*. This agrees with our observations of the surface temperatures of the four years 1901–1904; but 1905 forms an exception in this as in other respects.

4. "The mean temperatures and the volume of the Atlantic water below the

surface, in a section across the southern Norwegian sea in May, can be used for the prognosis of the character of the air-temperature of Norway in the following winter, the time of the Lofoten fishery (whether early or late) the following winter, probably also the character of the spawning, and the relative quantity of cod-liver.

"The *surface temperature* of the Atlantic water along the same section in May can be used for a prognosis of the growth of the fir wood during the summer a year later, and the quantities of the products of agriculture in the following autumn, in a similar manner as the air-temperature in the spring may be used for the same purpose."

The authors point out that there seems to be a good agreement between the curve representing the variations in quantity of cod-liver and the curve showing the variations in the number of sun-spots, the maximum of cod-liver having a marked tendency to coincide with the minimum of sun-spots. But the periodicity in the sun-spots, or rather in the energy received from the sun, causes variations in the oceanic currents (either directly or indirectly, through the atmosphere), that have a great influence on the climate of Norway and the fisheries, as shown in the above-mentioned conclusions.

The Norwegian Coast Water.—"Coast water" means waters that are found along the coasts with a salinity below 35·00 per mille. The boundary between the Atlantic water and the coast water is generally sharply defined.

The surface salinity along the west coast of Norway, outside the "Skjaergaard," is generally above 31 per mille, increasing towards the Atlantic current. The coast water is moving along the coast of Norway, being a continuation of the Baltic current, from the Skagerack up to the Barents sea. It is worth noting that the average salinity, on the whole, increases along the route of the coast water, while it is the reverse for the Atlantic current. The temperature of the coast water in the Skagerack follows more closely the air-temperature on the Continent than farther to the west and in the Norwegian sea, where the "climate" of the coast water is much more like "oceanic climate" with comparatively small variations.

The coastal current of Norway originates from the Baltic current passing through the Kattegat into the Skagerack. The velocity near the surface is about 1 metre per second. It receives river-water from the fjords.

The variations of the coastal current depend on different factors, as the rainfall and the melting of ice and snow on land, the air-temperature and the insolation. The authors found a very interesting relation between the variation of the coast water and the fisheries of sprat and small herring. Observations during a period of five years show that a small area of coast water (May) corresponds to small catches (autumn) of sprat in the same year, and of small herring in the following year. As the coastal-water variations correspond to the variations of rainfall during the previous year, there should be a correspondence between the rainfall of a certain year and the sprat fishery a year afterwards, as well as the small herring fishery two years afterwards.

Polar Currents.—In chapter ix. we find a description of the Polar currents, based principally on surface observations collected in the Arctic seas by sealing and whaling captains, on observations from Captain Roald Amundsen, and from the *Belgica* Expedition.

The Polar water is a typical coast water, with salinities from 30 per mille at the surface to 34·7 per mille at 90 or 100 fathoms, and with temperatures varying from −1·8° C. to 0° C. The typical feature of the Arctic seas and currents is the presence of an intermediate warm layer between the top layer of Arctic water and the cold bottom layer filling the deeper parts of all northern seas. The presence of

this warm layer is due to the fact that there is a gap in the density between the lighter Polar waters with low salinities and the much heavier bottom water. Waters of Atlantic origin, with densities corresponding to the gap, come from the adjacent seas and flow between these two layers.

There are three Polar currents running into the Norwegian sea: the Bear island Arctic current; the Spitsbergen Polar current; and the East Greenland Polar current. The Bear island Arctic current comes from the Barents sea, and follows the southern slope of Bear island bank. It is composed of Arctic water with temperatures between 0° C. and −1° C., and salinities below 34·7 per mille. This narrow and almost insignificant current often carries ice far towards the south-west of Bear island, and may be dangerous for navigation. The Spitsbergen Polar current runs round South cape, Spitsbergen, and northwards along the west coast, inside the Spitsbergen Atlantic current. It affects the navigation, as it carries ice along the coast, round South cape, in the early summer.

The East Greenland Polar current comes from the North Polar basin; it runs along the north-eastern coast of Greenland, and crosses the ridge between this coast and Spitsbergen, and follows the edge of the Greenland continental shelf southwards. It is composed of cold water with temperatures below 0° C., and with low salinities. If one considers the conditions of motion of this current, it will be found that they are similar to those of the Atlantic current off the Norwegian coast, the greater velocity being limited to the continental slope and the edge of the continental shelf, while the motion is comparatively slow over the shelf. The main body of the current is narrow, and only 100 metres deep. The vertical distribution of temperature and salinity in the cold layer of polar water has the same characters both in the East Greenland Polar current and in the North Polar basin.

The East Iceland Arctic current is formed by admixture of Atlantic water from the Atlantic current, of Polar, Arctic, and Iceland coast water. The authors point out that the designation "Polar" to this current is misleading, as it contains only a small quantity of Polar water. The authors call "Arctic water" the water formed in the Norwegian sea by admixture of Atlantic water with originally Polar water and with water cooled during the winter in the Norwegian sea, and which during the summer may be diluted by the water of the melting ice. The greatest motion of this current is limited to the continental slope on the right side of the current.

The "tongue" of Arctic water over the Færoe-Iceland ridge certainly follows the cyclonic movement of the southern Norwegian sea, and the last traces of its water disappear near the central part of the cyclone, on account of intermixture with the surrounding waters. The "tongue" is formed of Arctic water, evidently coming from the deeper layers of the East Iceland Arctic current.

Ice.—There are two kinds of ice occurring in the region of the East Greenland Polar current, viz. North Polar ice and Arctic ice. The former ice comes from the North Polar basin. It forms extensive floes, 2 to 3 metres thick, with great hummocks 60 to 70 metres thick. The latter ice is formed between Jan Mayen, Greenland, and Spitsbergen, and between Jan Mayen, Greenland, and Iceland. It consists mostly of floes about 1 metre thick, formed during the preceding winter and melting during the following summer. The authors point out the importance of this difference, that has not been taken into account by those who frame theories based upon the variations in the distribution of ice.

The authors are led, by the study of the ice and of vertical temperatures, to the following conclusion: "The cover of ice protects the underlying sea against the cooling by radiation of heat from the surface during the winter, and much heat is moreover disengaged by the formation of new ice."

The Cyclonic Systems of the Southern and Northern Norwegian Sea.—The great primary system of circulation is formed by the Norwegian Atlantic current running along the eastern side-slope of the Norwegian sea, and by the East Greenland Polar current flowing on the western side-slope. It is a cyclonic movement round the whole of the Norwegian sea and basin, along its side-slopes. This primary system is divided into several smaller systems, very likely on account of the topographical features of the sea-bottom. The authors point out how perfectly their chart of the movements in the southern part of the Norwegian sea agrees with Dana's chart of the distribution of *Calanus finmarchicus*, *Calanus hyperboreus*, and *Pseudocalanus*. According to Gran's and Dana's studies, different plankton organisms, like the *Calanidæ*, are characteristic for certain areas in the open sea, where they are stationary. The areas where these organisms have been found correspond exactly to those where the water masses are more or less stationary.

The westerly movement of the Atlantic water in the northern part of the Norwegian sea (about 75° N. lat.) may be compared to the westward movement of the same water west of Lofoten. It coincides in a remarkable manner with the hypothetical low elevation of the sea-bottom off Spitsbergen, trending in a south-western direction.

In the sea west of Spitsbergen the branch of diluted Atlantic water sinks under the Polar current and forms the intermediate warm-water layer. The formation of this branch corresponds to the presence of a submarine ridge trending westwards from the northern end of Prince Charles foreland. The central part of the great cyclonic system of the northern Norwegian sea is the area where the bottom water is formed during the winter.

The Bottom Water.—The formation of ice during winter and spring increases the salinity of the surface water, which then sinks beneath the surface to form at first an intermediate layer. The vertical circulation gradually extends deeper and deeper, until finally what was originally surface water sinks to the bottom, forming a bottom stratum characterized by low temperature (0° C. to −1°·3) and very uniform salinity (about 34·92 per mille).

Nansen pointed out, in 1906, that the bottom water cannot get out of the Norwegian sea. But if this water is warmed up to 0° C. by admixture with the warmer overlying strata, it can be carried out chiefly by the Polar current. On the other hand, very small quantities of bottom water can be formed each winter by the cooling of the sea-surface in such a limited area. The authors conclude that the bottom water of the Norwegian sea, forming the floor of the currents, remains practically unaltered for a very long period of years.

This book throws light into the darkness of the ocean, and will be read with great profit, not only by oceanographers, but also by those who are interested in the problem of the fisheries. Indeed, by the accurate methods employed, Helland-Hansen and Nansen have proved that physical oceanography can and must be an exact science. Their conclusions on the relations that exist between the annual variations of the Norwegian Atlantic current and the Lofoten fisheries, between the variations of the coast current and the sprat and small herring fisheries, are of great value from an economical point of view.

LEON W. COLLET.

REVIEWS.

EUROPE.

AUSTRIA-HUNGARY.

'Austria-Hungary.' By Geoffrey Drage. London: Murray. 1909. Pp. xix., 346. *Maps.* 21*s.*

THIS is a comprehensive and authoritative volume on a subject which has received by no means too full treatment at the hands of English writers. It is divided into three parts, one being devoted to Austria, the second to Hungary, and the third to the common affairs of the dual monarchy. In each part, history, the people, resources, commerce, and finance are fully dealt with, and there are special chapters on those parts of the empire which demand them—Croatia-Slavonia, Bosnia and Herzegovina—as well as on the region in which the chief external interests of the empire lie—the Balkans. Full use is made of coloured maps. There is only a small general map, as physical description has not a leading part in the scheme of the book, but in connection with the history of Austria there are six maps of Europe at various periods from the Crusades to 1815. They are clearly printed, but would have been improved by explanatory keys to the colouring. The medium of the map is also used to show the distribution of agrarian socialism in Hungary, of races in the empire and in Europe, and of religions in Europe. Appendices provide the student of political geography with ready access to fundamental laws and various important treaties, and the economist with statistical tables, otherwise difficult of access in any form, but here Anglicized, at what must have been considerable labour. There is a full and well-arranged index.

THE NORTH EUROPEAN SEAS.

'Report on Norwegian Fishery and Marine Investigation.' Vol. 2, No. 1. 1909.

In this monograph, we have a detailed yet concise review of the excellent work carried out on board the s.s. *Michael Sars* between and during the years 1900 and 1908. The area covered extended over the Scottish and Danish waters as far north as Spitzbergen, but the chief efforts of those engaged were concerted upon the Norwegian waters lying between the coasts of Norway and Iceland.

Dr. J. Hjort, in the opening pages, gives an interesting description of the s.s. *Michael Sars*, including a full account of her gear and methods of working. It is, of course, a matter of congratulation that the Government so readily responded to his suggestions to fit out a sea-worthy boat like the *Sars*, specially and fully equipped for the work. He and his colleagues deserve a further word of praise for the excellent results which they have obtained. The work not only embraced fishery experiments of fundamental importance, but interesting ocean research carried out at all seasons of the year and under all conditions of weather. The North sea and Norwegian sea are by no means centres of pleasure-cruising, even in midsummer, and to undertake steady scientific research necessitated a stoutly built boat, a hardy crew, and a stout-hearted scientific staff. Owing to the wide expanse of sea taken in by the Norwegian Fishery Investigations, lying for hundreds of miles along the coast of Norway as far north as Jan Mayen and extending seaward as far west as Iceland, it is hardly possible to run for shelter. This large stretch of water is almost continually swept by storms, which are more or less of a permanent character in winter, and it says much for the staff of the *Michael Sars* that they have been able to accomplish so much.

In the short space at our disposal, it is impossible to even briefly summarize the many additions to our knowledge of the hydrographical and biological

conditions of the North sea that the members of the Norwegian Fishery Investigations have been the means of making. Much has been done by them in studying the temperature, salinities, and current movements, and in planktonic and bottom fauna investigation; also in observing the spawning areas of different fish, and noting the drift or migration of fry and larvæ. That currents have much to do in affecting both the feeding-grounds of the fish and also of the fish themselves is evidenced by the fact that in 1900 the *Michael Sars* found the fry of cod, haddock, and saithe drifting hundreds of miles from their supposed spawning-grounds.

The question of currents is an important one, and is receiving a considerable amount of attention by the International Fishery Investigations. The direction of the main currents in the North sea are now very well known, and also a little about their velocity, which in places is considerable, and must affect the bottom very largely. Less is known of the minor currents, of which there are many in such a shallow body of water. This is shown to a great extent by the patchy nature of the bottom, fine silts and sands cropping out midst coarse grit and gravel. To attempt to map out such a heterogeneous mixture of deposits is almost impossible. It was attempted by Thoulet for the English Channel, but the results were somewhat confusing. The southern portion of the North sea floor is being done in much the same way by the Lowestoft Laboratory of the International Fishery Investigations, but the result will no doubt be somewhat like a Chinese puzzle. R. D.

THE BALTIC.

'Finnländische Hydrographisch-Biologische Untersuchungen. No. 1. Hydrographische Untersuchungen im nordlichen Teile der Ostsee, im Bottnischen und Finnischen Meerbusen in den Jahren 1898–1904. No. 2. Untersuchungen zur Kenntnis der Wasserbewegungen und der Wasserumsetzung in den Finland umgebenden Meeren, I. Der Bottnische Meerbusen in den Jahren 1904 und 1905.' Erster Teil. Von Rolf Willing. Helsingfors: Helsingin Uusi Kirjapaino-Osakeyhtio. 1908.

The land-locked Baltic sea with its low salinity and large variations, caused by the submarine sills and the fluctuating discharge of the rivers, is an interesting basin to oceanographers, and has been investigated by Swedes, Danes and Germans, and to some extent by Russians. Of late years Finnish hydrographers have taken their full share of the work, having undertaken at the Congress of Naturalists at Stockholm in July, 1898, to carry out soundings and observations in the Gulf of Bothnia, the Gulf of Finland, and the adjoining part of the Baltic. During the years 1898–1904, the number of stations visited was 177, where meteorological observations were made in the air, the temperature of the water noted at different depths, and specimens of water collected. The proportion of chlorium in the water was determined by titration, and hence the salinity was calculated by Knudsen's formula. The analysis of the absorbed gases was performed by Prof. Pettersson's method.

During the years 1904 and 1905 thorough investigations were carried out in the Gulf of Bothnia, and besides the examination of the water, numerous observations were made with a bifilar current meter of Pettersson's pattern, and in 1905 electricity was applied to the registration of the results. The water-level and its fluctuations, with the contributing causes, rainfall, river discharge, wind, etc., were carefully studied, and also the tides. Experiments were made with floating bottles, both free and with weights attached at different depths. A large part of these volumes is taken up with tables of the observations, and numerous maps and diagrams are appended. Other volumes are to follow, and on their appearance it will be possible to obtain a general idea of the results obtained. W. A. T.

'Britain's Sea Story.' By E. E. Speight and R. Morton Nance. (London: Frowde. 1909. Pp. xiii., 427. *Illustrations.* 5s.) That a third edition of this collection should have been called for is a tribute to the care exercised by the editors in selecting the extracts from early narratives which form the bulk of the volume. The introduction on ancient and mediæval ship-building is most interesting. The book is designed on popular lines, to which garish coloured illustrations seem almost necessarily, in these days, to belong.

'Great and Greater Britain.' By J. Ellis Barker. (London: Smith, Elder, 1909. Pp. x., 380. 10s. 6d.) This volume of social, political, and imperial essays appears at an appropriate time. The essayist has the advantage that partisanship is expected of him, and Mr. Barker supports his contentions ably. One may notice here that in his first chapters he introduces as an illustration a concise sketch of mediæval economic geography in Europe, and other similar examples show the wide scope of the work.

'Cambridge County Geographies. Westmorland.' By J. E. Marr. (Cambridge: University Press. 1909. Pp. ix., 151. *Maps and Illustrations.* 1s. 6d.) This series seems to improve as it grows. In no volume which has been before us hitherto has the text, necessarily compressed as it is, been written with such interest of style, in none have the illustrations been so generally excellent, nor has the impression of value for the remarkably low price been so strongly conveyed. The fine scenery of the county receives full measure of scientific and artistic treatment.

The same. 'Gloucestershire.' By H. A. Evans. (Cambridge: University Press. 1909. Pp. ix., 155. *Maps and Illustrations.* 1s. 6d.) This volume is also very well written, and nothing could be better than the selection of illustrations, which show very well the scenic and architectural characteristics of the shire.

'Highlands and Byways in Middlesex.' By W. Jerrold. (London: Macmillan. 1909. Pp. xviii., 400. *Maps and Illustrations.* 6s.) The present volume will take a high place among those of this well-known series. Mr. Jerrold's style is no less engaging than that of any of his fellow-authors, while Mr. Hugh Thomson's illustrations are better than many others.

'The Isle of Man.' By Agnes Herbert. (London: Lane. 1909. Pp. xvi., 270. *Illustrations.* 10s. 6d. *net.*) This is avowedly a "colour-book," and in such the text often has a secondary part. This cannot be said of Miss Herbert's, which is always pleasant reading, though pretending nothing great in the way of scientific or historical worth. Some of Mr. Maxwell's pictures are pleasing, and the book is worth the notice of those who want impressions of the island.

'British Mountain Climbs.' By G. D. Abraham. (London: Mills & Boon. 1909. Pp. xvi., 448. *Illustrations and Diagrams.* 7s. 6d.) Mr. Abraham has given us good reason to expect an authoritative and attractive volume whenever he deals with this subject. In the present case his object is to provide a handbook of convenient size, and this is done successfully in spite of the large number of pages and the usual clever illustrations from the author's camera. The climbing directions read explicitly, and are arranged on clear topographical plans. References are given to Ordnance Survey maps.

'Conway and Coolidge's Climbers' Guides. The Bernese Oberland.' Vol. 1, part I. By the Rev. W. A. B. Coolidge. (London: Fisher Unwin. 1909. Pp. xxiv., 155. 10s.) The new edition of this volume of a well-known series has been carefully rewritten and brought up to date. It is of service not only to climbers, but to ordinary pedestrians as well, and it contains interesting studies of the history of the names borne by the various peaks and passes. While the book

is of unique value in authority, its style of production would seem hardly to justify its price.

'Italy To-day.' By Bolton King and T. Okey. (London: Nisbet. 1909. Pp. xii., 414. 6s.) This volume has already been recognized as an authority on the intricate questions of Italian home affairs, and the new edition has not only been brought up to date, but considerably expanded. The student of economic geography will find here a plethora of facts and figures, the latter properly adapted to English usage.

'Grieben's Guide Books: Lakes of Northern Italy and Milan.' (London: Williams & Norgate. 1909. Pp. 153. *Maps.* 3s.) This seems to be a good ordinary guide, but suffers noticeably from indifferent translation in parts. Its chief recommendation is its handy size.

'Bosnia and Herzegovina.' By Maude M. Holbach. (London: Lane. 1910 (*sic*). Pp. 249. *Map and Illustrations.* 5s.) This volume, with its excellent photographs, gives an attractive account of a country little known to the tourist, but probably soon to become better known. The style is light and pleasant reading, and the book, though mostly a personal narrative, will be found serviceable to intending travellers in the country.

ASIA.

Sikkim and Bhutan.

'Sikhim and Bhutan: Twenty-one Years on the North-East Frontier.' By John Claude White. London: E. Arnold. 1909. 21s. *net.*

A veritable land of enchantment is that far end of the Himalayas which includes Sikhim and Bhutan—of enchantment, that is to say, in all that pertains to those lasting impressions which are derived from the most magnificent scenery that the world can produce. But it must be confessed that the enchantment is largely tempered by certain physical disadvantages, amongst which are to be reckoned a plague of leeches and the persistent trouble of a heavy rainfall. Possibly these two great plagues are intimately related. The memory of Bhutan (across an interval of nearly fifty years) recalls firstly the wide flat spaces of the Duars, thickly covered with dense grass, through which an elephant or a rhinoceros could push his way with difficulty, and beneath which tigers could sneak along the narrow tracks trodden by the hosts of smaller game. Then came the forest growth of the foothills, with magnificent trees and a spread of bamboo jungle such as is unknown in the undulating plains of the Indian peninsula. These filled the low steaming valleys and reached upwards to 10,000 feet of altitude. Beyond this, again, past the forests where the long grey beards of lichen drooping from the branches lent an air of venerable age to the moist scenery, and where leeches curled themselves in myriads in the tangled undergrowth, is the Bhutan of Mr. Claude White, spreading itself in majestic grandeur to the cold passes of Tibet; crowned with a magnificent array of snow-capped peaks, with here and there open valleys and grassy undulations, carpets of flowers, and all the glory of scarlet rhododendrons massed in such a blaze of colour that the eye is almost wearied with its profusion.

Mr. White is by training an engineer whose opportunities of dealing directly with the native officials of this Eastern frontier land specially qualified him for the interesting political duties which he was long ago called upon by the Indian Government to undertake. His sympathetic nature and power of ready adaptability to strange circumstances and surroundings have been valuable assets in the making of his career, but it is only his love of adventure and his deep appreciation of all that is beautiful in nature and art which render him capable of presenting to the public a book so full of interest as that which we have just read. It is not often

that the one man who has the widest and most complete knowledge of his subject is able to render a faithful account of just those special characteristics of it which mark it as distinct from all others; and in this Mr. White has been largely assisted by his quite extraordinary skill as a photographer. Rarely has the beauty of Himalayan scenery been so well illustrated, and never have the idiosyncrasies of a strange people with the specialities of their most interesting form of architecture been so judiciously treated.

Bhutan is a new and strange land to most of us. There is not much literature about Bhutan. Those emissaries of the Indian Government who, at long intervals, have passed through it to Tibet, or endeavoured to frame commercial treaties since the days of Warren Hastings, have described their experiences and coloured their views according to the impressions left by the nature of their reception; and the result has been a very varied and confused general notion of the conditions, natural and social, which govern that country. Mr. White has had every temptation to write in an optimistic vein, for nothing could exceed the personal friendliness towards him which was everywhere expressed; but his observations were close and his mind is judicial, and we may learn from his book quite a new story about Bhutan and the Bhutanese. The only unpleasant reading in the book are the criticisms which he is forced to make on the shifting and unsatisfactory policy of the British Government, which has over and over again left its friends in the lurch, and wasted enormous sums of money over half-completed public works, owing to its fatal want of continuity as regards the north-eastern, or indeed any other part of our Indian frontier. Tibet, as Mr. White points out, is now absolutely Chinese; the Chumbi valley is Chinese, and the Lhasa expedition might never have been. How this will end it is impossible to say, but whilst the attitude of Bhutan towards the Indian Government is (thanks to such men as Messrs. Paul and White) one of friendly aspiration, these hopes are much tempered by their bitter experiences of what they consider to be want of good faith. They are very human, and not at all unreasonable. At present Bhutan may not count for much in Indian politics, but though the day may still be distant, the time will surely come when Bhutan in the north-east will be as important to Imperial interests as is Kashmir in the north-west—and for very similar reasons. It will certainly be a very long time before we are in a position to learn more about this not unimportant corner of the Himalayas than is to be learnt from Mr. White's book. The details of his story may well be left to those who wish to acquire sound information.

T. H. H.

'Through Persia from the Gulf to the Caspian.' By F. B. Bradley-Birt. (London: Smith, Elder. 1909. Pp. x., 331. *Map and Illustrations.* 12*s.* 6*d.*) The author, on a journey homeward from India, travelled up the Persian gulf to Bushire, and thence by Shiraz, Isfahan, and Teheran to the Caspian. His narrative makes interesting reading, and the fact that he claimed the assistance of Sir A. Houtum Schindler adds to the authority with which he writes of Persian social and political affairs.

'An Overland Trek from India.' By Edith F. Benn. (London: Longmans. 1909. Pp. xv., 343. *Map and Illustrations.* 15*s.*) This is an entirely personal narrative, not originally intended, we learn, for publication. The greater part deals with residence and travel in Persia, and as the writer's husband, Major Benn, occupied an official position there, she had peculiar opportunities for gathering knowledge about the country and its people.

'The Face of China.' By E. G. Kemp. (London: Chatto & Windus. 1909. Pp. xv., 271. *Map and Illustrations.* 20*s.*) The author's travels in China have

been extensive, ranging from Peking to the furthest extremity of Yunnan. His chief specialised interest appears to have lain in religious and educational matters. He illustrates his own chapters with a large number of coloured and sepia drawings.

'China: its Marvel and Mystery.' By T. Hodgson Liddell. (London: Allen. 1909. Pp. xiii., 203. *Illustrations.* 21*s.*) This is primarily a picture-book, and the author-artist's sketches are beautiful and beautifully reproduced. Not only so; speaking purely from the artist's point of view, he broke a good deal of new ground, and though not a few of his scenes are familiar, he presents them, with both brush and pen, in new lights.

'A Scamper through the Far East.' By Major H. H. Austin. (London: Arnold. 1909. Pp. xvi., 336. *Maps and Illustrations.* 15*s.*) The general character of this book can be guessed from the title: it deals with a journey by the Trans-Siberian railway to Manchuria, and so to Korea and Japan. But the author has a good deal to say on recent and current affairs in the Far East, and his most interesting work in his topographical study of many of the principal battle-grounds in the Russo-Japanese War.

'My Thirty Years in India.' By Sir Edmund C. Cox. (London: Miles & Boon. 1909. Pp. x., 306. *Illustrations.* 8*s.*) This book deals mainly with personal experiences, but the author's intimacy with Indian police administration enables him to write with authority on some of its problems.

'Thirty-seven Years of Big Game Shooting in Cooch Behar, the Duars, and Assam.' By the Maharajah of Cooch Behar. (London: Ward. 1908. Pp. xxviiii., 461. *Map and Illustrations.* 21*s. net.*) These records of royal sport make a volume as heavy as the reading is light. They will be read with interest, and perhaps envy, by other sportsmen; but the author has not associated any science with his sport.

'A German Staff Officer in India.' By Count Hans von Konigsmarck. (London: Kegan Paul. 1910. Pp. xiv., 340. *Illustrations.* 10*s.* 6*d.*) There is little but personal reminiscence in this volume, though it is a pleasure to read appreciation so unstinted from a foreigner. In his free use of colloquialism the translator has no doubt sought equivalents for the original German.

'The Place of India in the Empire.' By Lord Curzon. (London: Murray. 1909. Pp. 46. 1*s.*) This is an address delivered before the Philosophical Institute of Edinburgh, and contains a brief but suggestive analysis of the geographical position of India in regard to political and strategical considerations.

'Folk-lore of the Santal Parganas.' By C. H. Bompas. (London: Nutt. 1909. Pp. 483. 10*s.* 6*d. net.*) This volume consists principally of translations of the original native stories carefully collected and transcribed. They indicate the rich field which awaits investigators in this branch of ethnographical study. Both translations and the brief introduction are admirably done.

'Fryer's East India and Persia.' Vol. 1. Edited by W. Crooke. (London: Hakluyt Society. 1909. Pp. xxxix., 353. *Illustrations.*) John Fryer's narrative of his travels in 1672–1681 is full of interest both in matter and in manner. It is well that it should have been produced with the care which the Society always devotes to its publications. The editor's biographical introduction, moreover, is excellent, and his notes never appear to deserve the charge which he himself offers against them, of unreasonable length.

AFRICA.

African River Vegetation.

'Die Pflanzenbarren der Afrikanischen Flüsse.' (Münchener Geographische Studien, No. 24.) By Oswald Deuerling. München: 1909. 5*s.* 6*d.*

In this monograph Dr. Deuerling has brought together a very large amount of information bearing upon the blocking of river channels by vegetation, and, as the

matter is of no small practical importance in the Nile basin, this work is especially welcome. Marno described the sadd blocks of the Bahr-el-Jebel some thirty years ago, and recently several accounts of the operations undertaken for the purpose of removing these obstructions have appeared, but no full account of them has hitherto been published.

The writer first discusses the various ways in which vegetation may encroach upon areas of open water and upon rivers; in the former he includes marshes and moorlands, the mangrove swamps of the seashore, floating grass and floating islands, such as Chipampai of Mexico, and the periodically "floating land" of Waakhusen, north of Bremen. He next deals with the obstructions formed by vegetation in certain rivers of Europe, Asia, and America, and also in those of Africa, which are treated in greater detail since the instances from the Sudan, from the Congo, from South and Central Africa, and from the upper Nile are treated separately. Finally, the "sadds" of the upper Nile are treated fully, and the character of the region in which they principally occur, their composition, their formation and distribution, and their removal, are all investigated and discussed.

He quotes numerous cases in tropical Africa of the dense growth of papyrus and other hydrophilous plants which reduce the open water-surface of many streams to an insignificant width, the "rush drains" of Speke. The further development of a continuous felted layer of grass vegetation is exemplified by the "*obä*" of the upper Aruwimi river, a tributary of the Congo, where the vegetable covering is tough enough to bear man, but not the heavier quadrupeds, such as the antelope, buffalo, or elephant. Floating islands formed of tree-stems, masses of bank with its vegetation, or grass islands, are likewise alluded to, and their distribution is discussed. Following this an account is given of the barriers of vegetation in Europe, Asia, and America, and a fuller one of their occurrence in the rivers of Africa, where they are more common.

After this preliminary discussion of the characters of these special effects of vegetation and of their distribution and occurrence, a full account of the sadd-blocks of the upper Nile occupies more than half the book. The author protests against the loose employment of the term "sadd" outside its strict meaning of a mass of vegetation blocking a water-way, and quotes an extreme case of misuse where fossil reeds in the Sahara are described by this term of very definite and restricted application.

The physical and climatic conditions of the region of the Bahr-el-Jebel and Bahr-el-Ghazal are set forth fully, both recent work and the accounts of early travellers being utilized, and a full account of the vegetation of the marshes is added, which a special appendix amplifies by furnishing a list of the plants which have been determined from them.

The rest of the memoir is devoted to a full and detailed account of the formation of sadd-blocks, their composition, their distribution, the methods of removing them, and other phenomena connected with this form of interference with the water-system by vegetation. All available sources of information have been utilized. References to such sources are numerous and ample, almost a thousand reference notes being given, and some of them contain indications of several authorities. In this way a valuable summary of information relating to an interesting and important geographical phenomenon has been prepared, and has been brought down to the date of the last published information on the subject. But this is about four years ago, and since then much of the Bahr-el-Jebel and the Bahr-el-Zaraf has been surveyed and levelled, new river-gauges have been established, and measurements of the volume discharged have been made at different seasons. None of those who have a knowledge of this recent work have as yet furnished any account of its

bearing on the interesting geographical problems of this region. There is every prospect of gain from a comparison with regions of similar character, and with increased information the water-logged valleys of these rivers might be profitably contrasted with those of other countries; in such an investigation Dr. Deuerling's work should be most valuable.

The conditions which determine the formation of sadd-blocks and their relative importance are not yet finally determined, and more detailed knowledge gained from accurate surveys may facilitate the solution of this problem. Stormy weather and high water-level, whether from heavy rainfall or from the rise of the Sobat in flood, or both, probably set in motion masses of readily detached vegetation; a winding, narrow river channel affords opportunities for a block being formed; but between this and the gradual closing up a channel by the growth of marsh plants and the drifting in of floating vegetation, there are many stages, and their investigation is a matter of both geographical interest and practical importance, in which full information is essential, and that which has been here collected will be valuable.

H. G. L.

The Oasis of Aïr and its Inhabitants.

'Les Touarag du Sud-Est: L'Aïr. Leur rôle dans la politique Saharienne. Par le Lieut. C. Jean. Paris: Emile Larose. 1909. 12 *fr.*

Lieut. C. Jean's book on the Tuareg of Aïr (or Asbin) is divided into four parts. The first part is a summary of the history of French expansion in the Southern Sahara, and is a useful record of what has been accomplished there since the year 1890. The third part tells of the tentative occupation of Agadez (the capital of the oasis of Aïr) in 1904–5, an occupation rendered definitive in 1906. The fourth part, called an *aperçu* of the *rôle* of the oasis in Saharan affairs, is in reality a discussion of the whole problem of the economic and political development of the central Sahara, that is the region between Timbuktu and Tibesti. This part is notable for Lieut. Jean's frank declaration that, in his belief, a trans-Saharan railway is not needed on political grounds, and would be detrimental to the commercial interests of the Sahara. He argues that the substitution of the railway for the caravan would deprive the Tuareg of their chief means of honest employment, and turn these nomads into simple brigands. In any case, the commercial future of France in West Africa is in its Sudan provinces, and the author is to be commended for his plain words as to the very limited part that the Sahara can play in the development of the French colonial empire. Nevertheless, Lieut. Jean is anxious that France shall do what she can to preserve the caravan trade, and to that end advocates an all-French route between Tunisia and Zinder. He is full of regret that Kano is British, and foresees the economic results which will follow the completion of the railway from the Niger to that city.

The second part of the book, which fills 189 out of its 394 pages, is the most valuable. It is devoted to a description of the oasis of Aïr. After pointing out the strategic and commercial importance which it owes to its geographical situation, the author traces the history of the country. It once formed part of the Songrai empire, though its inhabitants were Hausa, Aïr marking the northern limit of that enterprising people. The only relic of Songrai dominion to-day is the idiom spoken at Agadez and at Mgal, a small town on the route between Agadez and the Songrai capital, Gao. Then came the Tuareg, represented by the Kel (*i.e.* sons of) Gress and the Kel Oui, who, according to Lieut. Jean, made themselves masters of the oasis in the ninth century. This date is probably incorrect—indeed, it is impossible to follow the author in his reconstruction of the history, though he is to be praised for tackling a very difficult subject. From about the year 1300

the story becomes more exact. Certainly Tuareg have for a long period ruled at Agadez. The first sultan is said to have been a son of the Sultan of Turkey by a slave mother, sent to the oasis on the demand of the Tuareg for a ruler whom all could obey. The first armed conflict with the French occurred in 1900; to-day all the various tribes inhabiting the oasis acknowledge French authority.

Lieut. Jean follows his historical inquiries with a chapter on the topography of the country, which he aptly designates the Switzerland of the southern Sahara. He proceeds to depict the aspect of the land in terms that prove him a perfect artist in words. The "tormented mountains," "the wrinkled landscape which has lost its youth," the gorgeous flowers, the swift-flowing streams, all are described in such manner that the reader imagines he sees them before him. And this, perhaps, is the best way of teaching geography. Lieut. Jean, however, does more; he goes on to describe in detail the hydrography, flora, fauna, mineral wealth, climate, industries, and commerce of the oasis. Then follow chapters devoted to the Tuareg their manners, characters, costumes, tribal groupings, religion, and social life. It will be seen that, so far as knowledge of the oasis extends, the book is encyclopædic in its information. Throughout the author keeps himself modestly in the background, though much of the information given is the result of his own investigations. The map of Aïr, drawn by Lieut. Jean, is the best that as yet appeared of the country. Besides maps, there are over a hundred photographs (chiefly of Tuareg), and these add greatly to the worth of a most interesting volume.

F. R. C.

'In the Grip of the Nyika.' By Lieut.-Colonel J. H. Patterson. (London: Macmillan. 1909. Pp. xiv., 389. *Maps and Illustrations.* 7*s.* 6*d.*) This volume will be read with interest by all who are interested in British East Africa, and especially in its game preserves, by sportsmen, and generally by those who appreciate a well-told tale of adventure. The author carried out his researches in connection with game-preservation, and a boundary for the preserve, frequently in difficult, and once in tragic, circumstances. His maps show the geographical value of his work, but they are indifferently reproduced and printed too small.

'In Wildest Africa.' By P. MacQueen. (Boston: Page. 1909. Pp. xiii., 402. *Map and Illustrations.*) This book also deals with a hunting trip in British East Africa and neighbouring territories, but contains in addition some general geographical work, with especial reference to ethnography, together with a short survey of African exploration. There is a considerable (English) bibliography, and a great deal of general information will be found in the text.

'With Mulai Hafid at Fez.' By Lawrence Harris. (London: Smith, Elder. 1909. Pp. xvi., 270. *Illustrations.* 7*s.* 6*d.*) The sub-title of this volume, 'Behind the scenes in Morocco,' indicates its nature. As a newspaper correspondent who obtained the favour of Mulai Hafid, the author had exceptional opportunities for studying the life of the capital, of which little has lately been learnt from experience by Europeans. The book is illustrated with the author's own sketches.

'Les Civilisations de l'Afrique du Nord.' By V. Piquet. (Paris: Colin. 1909. Pp. ix., 396. *Maps.* 4 *fr.*) This is in effect a history of North-West Africa—that part in which France is chiefly interested—from the earliest times. It is a long story to compress into the compass of a small volume, but the author appears to have selected the salient incidents with good judgment.

'The Gateway to the Sahara.' By C. W. Furlong. (London: Chapman & Hall. 1909. Pp. xxvi., 306. *Maps and Illustrations.* 12*s.* 6*d.*) This volume gives a brief historical sketch of Tripoli, and a fairly comprehensive survey of its physical characteristics and the present commercial and political states of its people. The

author's experiences and adventures are well told, and he met with not a few dangers on his journeys.

'The Union of South Africa.' By the Hon. R. H. Brand. (Oxford: Clarendon Press. 1909. Pp. 192. 6s.) This volume, appearing at an appropriate time, is by a writer who served as secretary to the Transvaal delegates at the South African National Convention. Official considerations prevent him from dealing in detail with the discussions of the convention, but he is able to write with peculiar authority about the whole circumstances of the union, surveys the historical circumstances which led up to it, deals in detail with the executive and legislative arrangements, and indicates with first-hand knowledge the popular feeling on the various leading questions of the union.

'Southern Rhodesia.' By Percy F. Hone. (London: Bell. 1909. Pp. xv., 406. *Maps and Illustrations.* 10s. 6d.) We have here an ample volume on "the administrative and industrial development of Southern Rhodesia since its occupation by the British South Africa Company." The writer appears to have had ample assistance from official sources, and quotes fully from original documents. In view of the possible subsequent relations of the territory with the newly formed union, the book appears at an opportune time.

'The Ore Deposits of South Africa.' Part ii. By J. P. Johnson. (London: Crosby Lockwood. 1909. Pp. 51. *Diagrams.* 5s.) This work, of which only the second part is before us, deals in the first with the distribution and character of "base" metals in South Africa. The second deals with the Witwatersrand and Pilgrimsrest goldfields and others. It is a strictly technical work, copiously illustrated with diagrams, including distribution maps, which, however, would hardly be of service to any but metallurgists.

'Great Britain and the Congo.' By E. D. Morel. (London: Smith, Elder. 1909. Pp. xxvi., 291. *Maps.* 6s.) Mr. Morel's attacks on the Belgian "Congo system" command wide attention, and in this strongly worded exposition he is supported by Sir A. Conan Doyle in an introduction.

AMERICA.

Mexico.

'Mexico.' By C. R. Enock. London: Fisher Unwin. 1909. Pp. xxxvi., 362. *Maps and Illustrations.* 10s. 6d.

Mr. Enock's work is already well known through his books on 'The Andes and the Amazon' and 'Peru.' The present volume, like that on Peru, forms one of the "South American Series," under the editorship of Mr. Martin Hume. Mr. Hume contributes an introduction, which consists of a brief survey of what is much more fully elaborated in the text—the history of Mexico down to the present time. To this subject Mr. Enock devotes six chapters, and, besides showing himself to be amply grounded in its study, has evidently a keen eye for its romance. He has no less appreciation for the remarkable scenery and physical peculiarities of the country, which are dealt with in one chapter. Further chapters are devoted to the people, their cities and institutions, to life and travel, mineral wealth, and other resources of the country, its finance, industries, and railways. When a number of good photographs and a large contoured map are taken into consideration, it is seen that we have here an important general treatise on the country, by a writer who has travelled widely in it, has given himself careful training as an observer, and combines with this the interests of a historian and of a business man, so that he is enabled properly to appraise the wealth and

prospects of the country. There is a good index, and a bibliography, in which not all the works mentioned are dated or placed.

Mexico and Yucatan.

'The American Egypt: a Record of Travel in Yucatan.' By Channing Arnold and Frederick J. Tabor Frost. London: Hutchinson & Co. 1909. *Illustrations, Map, and Plans.* 16*s. net.*

It would be difficult for any one with a knowledge of Mexico and Yucatan to write with moderation about the book under review, so indiscriminate and unsympathetic is the treatment that the subject has received at the hands of the authors. No dates are given, but as the authors crossed the Atlantic in November, and had concluded their explorations in Cozumel by the time of the carnival, it may be surmised that the length of their stay in the country did not exceed four months.

One week in the "unpromising land" of Mexico is sufficient to show them that the capital is "a combination of Spanish squalor and Paris-cum-New York civilization—very lightly veneered over in some places."

Nothing appears to have pleased the authors but the tramcar service and the drive to Chapultepec. As for the people, "Burke could not 'find it in his heart to impeach a nation,' but one is sorely tempted to forget his advice in writing of the Mexicans. As a people they are disagreeable. . . . The Spanish Mexicans are sensual and apathetic; avaricious, and yet indolent. . . . The Mestizas—near half the population—have all the worst features of their Spanish and Indian parents."

The Mexicans have their faults, and some of the difficulties in front of them as a nation are sufficiently obvious, but one week's observation appears to be rather a short time on which to frame such a sweeping indictment. The authors go on to describe the habits of the people, discuss the government, and prophesy the speedy absorption of Mexico and Central America by the United States.

The authors took ship from Vera Cruz for Yucatan, and, after a short stay in Merida, proceeded to visit the ruins of Chichen Itza, where they were guests at the hacienda of Mr. Thompson, the U.S. Consul, and then went on to Valladolid. (Do the authors really think that they were the first Englishmen to visit Valladolid? They even forget Catherwood.) Here preparations were made for a journey through the country to El Cuyo (? El Cayo), and thence by boat along the coast to Cozumel. This should be the most interesting portion of the book, for although the route has been described by Stephens and Catherwood, this part of the country is rarely visited. The authors state that they were able to prepare a map of this north-eastern corner of Yucatan, which attains an accuracy no map hitherto published has attained; but, unfortunately, this map is not included in the volume, and no explanation is given of how the survey was made. Some three or four weeks were passed in searching the island of Cozumel for ruins, unfortunately with little result. Rough plans of the two small groups of ruins that were discovered are given on pages 179 and 181. After returning to Merida the travellers visited the well-known ruins of Uxmal, Labna, Kabah, and Sayi.

Two hundred pages are taken up with a description of groups of ruins in Central America extracted from accounts by various authors, but principally from Stephens and Catherwood, and with an attempt to prove that the art of building was introduced into America during the eighth century by a party of Buddhists from Java or India, who came by way of the Caroline or Marshall islands. It is not suggested that they came in considerable numbers, "they possibly numbered two or three hundred." They first built Copan and Quirigua, and then those who lived long enough moved on and built Palenque, Menohé, and Piedras Negras!

It is impossible to discuss such a statement in a short review, but it may

be safely asserted that it will not commend itself to any serious student of American archæology. It is supported by statements by various writers, by no means always correctly interpreted, and descriptions and illustrations from Stephens and Catherwood, ignoring to a large extent the great amount of work done since 1840. We may instance the description of the tablet of the cross from Palenque. The authors say, "the right-hand stone has been completely destroyed. Stephens conjectures, probably rightly, that it was covered with hieroglyphics like that on the left." This right-hand slab has been for many years in the National Museum at Washington, and this best known of all Maya monuments has been figured and described again and again.

We may permit ourselves one quotation to show the style of argument employed to support the authors' thesis:—

"In our description of Palenque we have mentioned one of the most curious of all the reliefs—that representing, according to Stephens, women with children in their arms. The Oriental survivals seem to be especially strong at Palenque, and it would not surprise us if in these women-figures there is hidden a cogent proof of the origin of America's first architects. In 'Buddhist Art in Asia,' Prof. A. Grünwedel writes: 'At Sikri, Yusufrai, excavated by Major H. A. Deane in 1888, was found a statue of a woman accompanied by three children, one of which sits astride of her right hip in true Indian fashion, and which she is about to suckle. Among sculptures at Lahore Museum is a statue of a woman completely draped and holding in her left arm a child. It is suggested that these are forms of Haritri, Mother of Demons. She was the mother of five hundred demons, or yakshas, to feed whom she daily stole a child. Buddha rebuked and converted her. An image of her was found sitting in the porch or in a corner of the dining-halls of Indian monasteries, holding a babe in her arms.' Why should not the Palenque figure be a representation of the Hindu goddess Haritri?"

Chapters on the social condition of Yucatan and on the flora and fauna conclude the book.

Before closing this notice we must call attention to the extraordinary letter which the authors saw fit to address to President Diaz on their return to England. As the President naturally took no notice of it, the authors have printed it in their book.

One might be amused at the self-conceit of the whole performance, were it not for the unfortunate results sure to follow. It almost looks as though, having failed to add much to our archæological knowledge, the authors were determined that no one else should have a chance of doing so, for how can a British Minister ever again have the face to ask for facilities or official attention for any Englishman who wishes to visit the more remote parts of Mexico?

It can only be hoped that if this book should ever be read by any English-speaking Mexican, he will understand that it is the expression of individual eccentricity, and that the procedure of the authors would not be endorsed by the many English travellers and residents who have enjoyed the hospitality of that most attractive country.

One ought to add that the authors confess to a very slight acquaintance with the Spanish language. A. P. M.

'The Grizzly Bear.' By W. H. Wright. (London: Laurie. 1909. Pp. x., 274. *Illustrations.* 7*s.* 6*d. net.*) The author has been not only a hunter of the grizzly, but also a scientific investigator. Therefore, in the course of an entertaining narrative, he has much to tell of the present and formerly wider distribution of the animal, its habits, and so forth.

'The Old and New Peru.' By Marie R. Wright. (Philadelphia: Barrie. 1908. Pp. 456. *Map and Illustrations.*) This bulky and very heavy volume contains a careful study of the history and modern condition of Peru, on which, indeed, it should prove a most valuable authority. It treats the modern country from every point of the political, commercial, and social aspects, and is beautifully illustrated.

'The Great Pacific Coast.' By C. Reginald Enock. (London: Grant Richards. 1909. Pp. xi., 356. *Maps and Illustrations.* 16*s.*) The aim of this work—to treat the whole Pacific coast of North and South America "as a physical and political entity"—is certainly bold and original. Perhaps it can hardly be felt that the author welds together the various and widely divergent interests of this vast subject sufficiently closely to justify his object, but whatever opinion may be held on this point, it must be admitted that he omits none of them, and preserves a fair perspective through all. The large and good map of the seaboard and the eastern part of the ocean deserves mention.

'Journal of an Expedition across Venezuela and Colombia.' By Hiram Bingham. (London: Fisher Unwin. 1909. Pp. viii., 287. *Map and Illustrations.* 10*s. net.*) This journey has been dealt with in the *Journal*, vol. 32, p. 329. It was made with the object of exploring the route of Bolivar's march in 1819, and the battlefields of Boyacá and Carabobo, and was carried out in 1906–7. But the author took the opportunity of making a number of biological and ethnographical observations, and this volume, which is mainly in diary form, is rather of scientific than of historical interest (apart from the mere narrative of the journey, which is well told). There is, however, a short historical sketch in addition to the study of the battlefields mentioned, and, among other results, the observation of weather and temperature regularly made during the journey may be mentioned.

AUSTRALASIA AND PACIFIC ISLANDS.

'Wanderings among South Sea Savages.' By H. Wilfrid Walker. (London: Witherby. 1909. Pp. xvi., 254. *Illustrations.* 7*s.* 6*d.*) The author's experiences extended over Fiji, New Guinea, Borneo, and the Philippines, and his interests would seem to have lain chiefly in the direction of ethnographical study. He and his companions were the first white men to visit and communicate with the peculiar "flat-footed" lake-dwellers, the Agai Ambu, in Papua. In Borneo he saw much of the Dyaks, and also provides an interesting account of the swallow's caves and the native methods of obtaining their edible nests.

'Neuseeland.' By M. F. Blassneck. (Bonn: Brock. 1908. Pp. viii., 139. *Map.*) This dissertation, presented at the University of Bonn, consists of a short general historical, physical, and economic survey of New Zealand. Special mention may be made of the careful and systematic analysis of mineral and agricultural products, in which a full use is made of statistics.

'Across Papua.' By Colonel Kenneth Mackay. (London: Witherby. 1909. Pp. xvi., 192. *Maps and Illustrations.* 7*s.* 6*d.*) The author has not only crossed the British territory in New Guinea in its northerly part, but has coasted practically the whole of it, and visited the D'Entrecasteaux, Trobriand, and other islands. He was occupied on a Royal Commission, but this volume is of course an unofficial narrative. It is full of information about the natives and economic products of the territory.

GENERAL.

'Words and Places.' By the Rev. T. Taylor; edited by the Rev. A. S. Palmer (London: Routledge. [*N.d.*] Pp. xxxvii., 425. *Maps.* 6*s.*) The first edition of

this work appeared in 1864, when, as the present editor points out, the study of place-names was practically untouched. He has carefully annotated those of the author's conclusions which later research does not support. Numerous as these are, the book is a monument of such remarkable care and erudition, with its long list of authorities consulted and its full indices, that a new issue is very welcome.

'Radioactivity and Geology.' By Prof. J. Joly. (London: Constable. 1909. Pp. xiii., 287. *Illustrations.* 7*s.* 6*d.*) This book is a development out of the suggestion that Prof. Joly's Presidential Address to Section C (Geology) of the British Association at Dublin last year should be "rewritten in a more extended and less technical form." A great deal more than mere rewriting, however, has been found desirable, and a good deal of addition has been made to the scope of the address. The geographical distribution of radium, so far as it has been investigated, is dealt with in considerable detail.

'The Natural History of Igneous Rocks.' By Alfred Harker. (London: Methuen. 1909. Pp. xvi., 384. *Diagrams.* 12*s.* 6*d.*) In this comprehensive volume the geographical distribution of volcanic activity is of course dealt with. Some of the diagrams are sketch-maps, illustrating the distribution of igneous rocks and various volcanic phenomena. As blocks in the body of the text, they are particularly well printed.

'The Autobiography of Nathaniel Southgate Shaler.' (Boston: Houghton, Mifflin. 1909. Pp. ix., 481. *Illustrations.* 16*s. net.*) This volume is divided between Shaler's autobiography and a memoir by his wife. His remarkable activity and versatility in geological and geographical writing may be judged from the lengthy list of his publications, and even this is stated to be incomplete. His career, also, was wonderfully varied and interesting.

'Some Principles of Frontier Mountain Warfare.' By Major W. D. Bird. (London: Rees. 1909. Pp. 41. *Maps.* 1*s.*) A brief essay, based upon Indian experience. It contains a few text-maps to illustrate theoretical positions of troops.

'Sailing Ships.' By E. Keble Chatterton. (London: Sidgwick & Jackson. 1909. Pp. xxi., 362. *Plans and Illustrations.* 16*s.*) This treatise on sailing vessels deals with "the story of their development from the earliest times to the present day." It is a story well worth bringing within the compass of a convenient volume, and has clearly necessitated a great deal of research. Much space is devoted to ships of antiquity, and in more modern times warships, trading-vessels, and yachts all receive adequate treatment. The book is profusely and excellently illustrated.

'The Races of Man and their Distribution.' By A. C. Haddon. (London: Milner. [*n.d.*] P. x., 126. *Illustrations.* 1*s.*) This is a handy book of reference to the broad classification and distribution of the races of the world, well arranged and tabulated for ease of reference, and carefully indexed. It is very well produced considering its extremely low price, and should meet with a demand.

'Sport and Travel Papers.' By H. Melladew. (London: Fisher Unwin. 1909. Pp. xii., 336.) This volume, issued for private circulation, shows the author to have travelled very widely in the pursuit of sport: he provides sketches from many parts of Africa, the Americas, the far East, etc., and his sport has been of the most varied.

'W. G. Lawes, of Savage Island and New Guinea.' By Rev. J. King. (London: Religious Tract Society. 1909. Pp. xxvi., 388. *Illustrations.* 5*s.*) This is a record of the life of one of the great missionaries of the Pacific, who died in 1907. The peaceful political settlement of the territory of Papua owed much to him.

'Anson's Voyage Round the World, 1740–1744.' Selections edited by C. G. Cash. (London: Rivers. 1909. Pp. xv., 131. *Map and Portrait.* 1*s.* 3*d. net.*)

There is a clear, brief introduction on the life of Anson and some of his colleagues in this volume, and the selections from Richard Walter's narrative of the voyage are judiciously made.

THE MONTHLY RECORD.

THE SOCIETY.

Commander Peary.—The Council of the Society have decided to award to Commander R. E. Peary a Special Gold Medal in recognition of his long-continued efforts in Arctic exploration, and especially on account of his last expedition, when he succeeded in reaching the North Pole in April, 1909. A silver replica of the Medal will be awarded to Captain Bartlett, who accompanied Commander Peary to 88° N. lat.

EUROPE.

Bornholm.—A careful study of the morphology of the Danish island of Bornholm has been made by Dr. G. Braun (*XI. Jahresber. Geog. Ges. Greifswald*, 1908–09), partly on the basis of his own investigations on the spot, partly on that of the existing literature. He has also had the advantage of information communicated by Dr. Grönwall of the Danish Geological Survey, who is engaged in working up the material collected by that survey. Structurally, the bulk of the island is composed of pre-Cambrian granite, which occupies all its north-eastern part. A characteristic feature of this is the pronounced development of ravines running either north-east and south-west, or at right angles to that direction, as is shown by the courses of the principal rivers. Abutting against the granite on the south is a series of Palæozoic sandstones and schists, followed, after a considerable time-interval, by secondary deposits, chiefly along the south-west coast. Tertiary formations have not hitherto been observed. The whole forms a worn-down stump composed of an ancient land and a coastal plain of composite structure, both placed by dislocations of the crust at about the same elevation, the rectangular form of the island being apparently due to the same dislocations. In course of ages the island has been subject to considerable changes of level, which have in turn increased and reduced its area, the latest movement having been one of elevation. Morphologically, the distinction between the granite and the sedimentary formations is of secondary importance, the action of the ice-sheet having smoothed over the surface of both to a large extent. The coastal plain formed during the course of the various vertical movements has been to a great extent destroyed, but its remnants form a morphological feature, distinct from the earlier land in its mode of origin, but presenting no very marked contrast in its surface features. The line of partition between the two is marked chiefly by the "fall-line" in the course of the southward-flowing streams, due to the elevation of the land during the *Ancylus* epoch, which necessitated a deepening of their channels, with increased fall as they reached the coastal plain. The last section of the paper is concerned with the various forms of the coasts, in relation to the varying geological formations.

Coblenz and its Sphere of Influence.—This subject is ably discussed by Dr. R. Martiny in *Forschungen zur deutschen Landes- und Volkskunde* (vol. 18,

No. 5). Only two or three of the many interesting geographical items in this thoughtful disquisition can be here quoted. The cultural influence of a city hardly admits of definite geographical delimitation. Its range is rather to be likened to concentric rings lessening in intensity from the centre outwards. It is therefore with an admitted element of arbitrariness that Coblenz's cultural influence is limited to an area of some 2000 square miles—a little short of that of the Government district of Wiesbaden and of the Bavarian Palatinate, and about one-hundredth of the German Empire. Enclosed as it is, however, by desolate highlands severing the districts gravitating culturally to Coblenz from the spheres of influence of the next influential towns, this region is so far geographically defined. Only in the valleys of the Rhine, Moselle, and Lahn do the cultural influences from Coblenz and those from other towns clash and mix. This region is the more attractive from the contrast it presents between the vintage of the valleys with its animated bustle, and the poor peasant life of the adjoining highlands—rising to nearly 2500 feet in the Hocheifel—with their heaths and forests. The Rhenish region generally boasts a more ancient culture than the rest of Germany. Down to the present it is distinguished by its material development and affluence, sensuous enjoyment, and business activity. Even in its little towns Rhineland is more urban than middle and east Germany. Through long civic progress its towns have accumulated comparatively large funds, with treasures of art, while the intercourse afforded by their great river has developed in the burgher a special facility in business and affability in manner. Penetrating the country, the Rhenish town-life has turned the peasant into something of a suburban man, innocent of the prejudice against the townsmen cherished by the Bavarian peasant. The vine-dresser is half mechanic and a hard bargain-driver, converting his wine into cash. The law of inheritance assigns to all his children an equal share of his lands. The formation of the Rhenish type of life is attributed principally to the immediate contact with France of a land which, an old Keltic habitat, was the more susceptible to Keltic influences impregnated by Roman culture. Down into the late Middle Ages the left side of the Rhine maintained its cultural superiority. The vine culture of the upper Rhine plain is divided from the agriculture and industry of the lower plain, itself largely infused with town-life, by the slate mountains. These latter are pierced by but a narrow strip of the Rhine valley, giving scope to the formation of no larger town than Coblenz, with its 50,000 inhabitants.

A New Route across the Northern Urals.—In a recent number of the *Deutsche Geogr. Blätter*, of Bremen (vol. 32, part 3), Mr. A. Sibiriakoff calls attention to a route across the Urals, between the basins of the Ob and Pechora, which, he thinks, may in the future attain some importance as a trade route by which the products of Northern Siberia may reach Europe. It connects the navigable waters of the Sosva, a tributary of the lower Ob, and of the Ilych, a tributary of the upper Pechora, by means of tributaries of these streams, which can be navigated by boats to within little more than 100 versts (66 miles) of each other. The land journey is thus shorter than that involved in the case of the frequented route between the Sygva and Pechora, and possesses the additional advantage of being free from the swampy ground which closes the older route during the summer months. In view of the fact that the navigation of the lower Pechora does not open till well on in July, Mr. Sibirakoff points out the advantages to be gainsd by the construction of a canal between the upper waters of the Pechora and the northern Dwina, which would give access to Archangel, a port already accessible to navigation by early in May. The making of such a canal should be no very difficult matter, as the existing portage between the two basins is only 8 versts (5 miles) in length, while the ground is low and in part sandy.

ASIA.

The Apsheron Peninsula.—A Russian correspondent, Mr. P. Volarovich, writes from Baku giving some of the results, as regards physical geography, of the recent topographical and geological surveys in the Apsheron peninsula and neighbouring parts of the south-eastern Caucasus, undertaken with a view to acquiring a more detailed knowledge of the petroleum-yielding area. They present, he says, a typical picture in miniature of desert relief. The peninsula, though morphologically part of the Caucasus, possesses a climate similar to that of the Trans-Caspian desert region—a high temperature, with evaporation in excess of precipitation. The signs of intensive aeolian activity are very marked, practically the whole relief, both in outline and in detail, being a result of such activity. The one exception is formed by the mud volcanoes, of which there are great numbers. The whole peninsula is without a stream or river system, and even the Sumgait, which forms its western boundary, dries up in summer. All the hollows are a result of wind action. Long deep valleys (true wadis) without any gathering ground for water are to be noticed, as well as broad lake-like depressions (so-called khors), often entirely dry. The destructive action of the wind makes itself visible chiefly along the lines of less resistance, following the strike of the strata, and it is observable that all the forms of negative relief (wadis, denudation valleys, and khors) coincide in direction with the strike. A remarkable instance is the valley of Kirmaku, situated in the centre of the peninsula, and occupying the median line of the Balakhani anticline. The floor of the valley is entirely free from alluvium, and with its horizontal surface forms a huge unbroken trench. The clear-cut crests of the sandstone strata can be distinguished at a distance of some miles. A second example is the great valley of Yasamal, lying west of the city of Baku. It too possesses no collecting basin, and its floor is likewise free from alluvium; but here we have an ancient wadi, and a thin layer of deposits with *Cardium edule* is traceable here and there. The typical forms of desert relief are clearly seen in the new topographical sheets on the scale of 1 : 8400 and 1 : 21,000, brought out by the Geological Committee. The open nature of the country has permitted an exact determination of the structural lines, and the map brings out clearly the close dependence on these of the orographical features of the desert. The tertiary strata of which the peninsula is composed contain much gypsum and chloride of sodium, and fresh water is so scarce that Baku has to obtain its supply from a distance of 100 miles. Recent research has also thrown light on the origin of the extensive deposits of conglomerate which occupy the wide basin of the Kuba district (in the northern part of the Baku government), and attain a thickness of 1000 feet. The surface forms a plateau, dissected by the existing streams, bounded on the north-west and south-west by the massif of the Shah Dagh. These conglomerates are pronounced to be of fluvio-glacial origin. The Shah Dagh was an important centre of former glaciation (though at present only its summit is snow-clad), and the deep and narrow U-shaped valley of Shah Nabat is barred by enormous wall-like moraines. The huge boulder fields of Kuba must have been formed by the impetuous streams which descended from the Shah Dagh.

Prof. Saposhnikoff's Latest Journey in the Altai Region.—This energetic traveller last summer carried out a journey in the Mongolian Altai, by which he has considerably added to the knowledge gained during his earlier journeys (*Petermanns Mitteilungen*, 1909, p. 372). The first part of the journey was devoted to the examination of the snow-covered group of Tabin-bogdo, near the point of junction of the Russian with the Mongolian Altai. At the sources of the Kanas, belonging to the basin of the Black Irtish, an important group of snowy peaks and glaciers was discovered, these being the only glaciers of the

southern side of the range. From Kobdo other explorations were carried out, on the one hand of the White and Black Kobdo rivers and the glaciers connected with them, and on the other of the Dain-gol and of the snow-clad group of Mustau to the south of it. Eventually the professor crossed the Tannu-ola to the upper course of the Kemchik, and thence returned to Tomsk across the western part of the Saian range. Traces of former glaciation were here observed, but the still glaciated groups lay mostly off the route followed.

The Port of Dairen (Dalny).—As one of the main ports of entry into Manchuria, Dairen possesses a particular interest, and the question of its economic development since the Russo-Japanese war is of much importance. A recently issued Consular Report (No. 4372, Annual Series), dealing with the year 1908, permits an estimate of the present position of the port as regards trade and industries. The Consular district of Dairen, comprising the Kwantung leased territory, has an area of 1220 square miles and a population at the end of 1908 of 427,117 (a considerable advance over that in 1907), of whom 29,773 were Japanese. Of the four principal towns, Dairen and its suburb Shaokangtzu accounted for over 41,000, while Port Arthur contained only 13,015. The harbour works at Dairen are still unfinished, and during the rush of the winter season the wharf accommodation falls far short of the needs of the port. An exact estimate of the state of trade is difficult to arrive at, but it may be stated in general terms that the import trade is satisfactory, and the export trade distinctly good. The total showed an advance of over 50 per cent. over that of 1907, Japan taking roughly two-thirds of both imports and exports, for, apart from irregular boats running to Chinese ports, the only means of communication was with that country. So far as imports are concerned, Newchwang still holds the premier place in Manchuria. By far the most important exports from Dairen are beans and bean-cake (the latter used as a fertiliser), the total production of beans having risen from 580,000 tons in 1907 to 830,000 tons in 1908, in which year the beginning was made of a trade with the United Kingdom and Europe. But while there remains a certain area of new land for bean cultivation, it is improbable that the trade will go on increasing indefinitely. It is thought that a prosperous future is in store for the manufacture of bean-cake and bean-oil, and, among other possible industries, the production of wild silk (the defects of which may, it is thought, be removed by a newly discovered process), and the manufacture of soap (from bean-oil), glass, and paper, are mentioned.

AFRICA.

M. Gentil in Western Morocco.—The French scientific traveller, M. Gentil, continued his investigations in Morocco during 1909, and in a communication to the Paris Geographical Society (*La Géographie*, vol. 20, p. 325) sums up the general results of an interesting journey from Casablanca through the country of the Zaer tribesmen to Rabat, and thence inland to Fez, the earlier section being through country practically unexplored. M. Gentil's competence as a geologist enables him to shed a valuable light on the physical relations of the region visited. The Zaer (whose territory lies north of that of the Shawia) comprise two main divisions—the Mzara and Gefiani, and as they are at feud with each other the traveller was able to traverse the district of the latter only, to whom he had obtained recommendations. The area occupied by the Mzara is a continuation of the littoral zone of the Shawia, and contains the same fertile areas ("tirs") formed by the decalcification, under a moist climate, of the Pliocene limestones of this tract. The country of the Gefiani is more broken, and consists of primary formations similar to those of the mountainous part of the Shawia country. It

is occupied by forests and pasturages, both the cork oak and the *Thuya* being abundant. The pasturelands are mainly granitic, with the typical characters of such a region. M. Gentil pushed inland to the upper valley of the Wad Gru, bordered by a chain which seems to belong to the Middle Atlas. On the way from Rabat to Fez the traveller journeys on the platform of West Morocco as far as the Sebu, and the same platform seems to extend north-east, separating the Rtff from the Middle Atlas. In this part of the country the "black lands" of further south give place to less fertile "red lands," which support a less profuse vegetation. The alluvial plain of the Sebu includes, however, some fertile tracts, but of different character and of more local occurrence than in the coastal zone further south.

M. Villatte in the Sahara.—We learn from *La Géographie* (vol. **20**, p. 313) that M. Villatte, whose early surveys in the Central Sahara are known to our readers (cf. *Journal*, vol. **27**, p. 87), returned to Wargla last December after completing a new mission, lasting over a year, to that region. The traveller had carried out a number of astronomical and magnetic observations in the Central Sahara and Northern Sudan, thereby supplying valuable data for the exact mapping of this part of Africa.

The Pacification of Mauritania.—The military column under Colonel Gouraud, to which was entrusted the establishment of French authority over the tribes of the Western Sahara north of the Senegal (cf. *Journal*, vol. **34**, p. 456), completed its work in October last, having dispersed the insurgents by a movement towards the Ijil region, and paved the way for the introduction of a fixed administration suited to the special needs of the country. According to a note in *La Géographie* (vol. **20**, p. 327), Colonel Gouraud has constructed a map of the whole region traversed.

The Nigeria-Kamerun Boundary.—The work of the British and German Commission for the survey of this boundary between the Cross river and Yola was completed during 1909, and some account of it is given by Captain von Stephani, the head of the German party, in the *Deutsches Kolonialblatt* for December 15 last. It was agreed that the two parties should carry out the triangulation independently on the territory of their respective nations, the two nets running therefore roughly parallel to each other, though sometimes overlapping, and linked together at various points. The various means of control afforded showed a most satisfactory agreement between the results of the parties, and the astronomical determinations also agreed well with the geodetic work; while the junction with the Cross river—Rio del Rey section of the boundary, laid down in 1905, was likewise surprisingly good. The new work has also proved the correctness of the determination of the longitude of Yola made in 1903. The labours of the commission were of the most arduous character on account both of the nature of the country and of the climatic conditions, and the health of the members suffered considerably. The escarpments of the tableland of north-west Kamerun extend up to the boundary, and the nearly vertical cliffs could only be climbed with difficulty. The line runs through a country inhabited by a complex of tribes speaking different languages, and intercourse with them was no easy matter. But by the exercise of care and tact friendly relations were on the whole maintained.

The Diamond Fields of German South-West Africa.—Little precise information regarding the newly discovered diamond fields of German South-West Africa has hitherto been available. A concise summary of the history of the discovery and the present state of knowledge concerning the mode of occurrence of the diamonds, contributed to the *Deutsches Kolonialblatt* for November 15, 1909, is therefore of much interest. The author is Dr. Paul Range, whose official

position as geologist to the government of the colony entitles him to discuss the subject with full knowledge. The first discovery, made in April, 1908, in the neighbourhood of Lüderitzbucht, was entirely due to chance, some stones which proved to be diamonds being picked up by a Cape boy, through whom they came into the hands of a German railway official. The most remarkable circumstance is that, during the construction of the Lüderitzbucht railway and the military operations against the Hottentots, thousands had passed over the ground on which the diamonds were lying, and some amount of prospecting for ore had been carried out in the district without revealing the presence of the stones. An important section of the paper is that in which the geological aspects of the question are discussed. The diamonds hitherto found all occur in secondary deposits, every attempt to discover their primary resting-place having proved fruitless. A marked feature is the parallelism of the diamond-bearing deposits with the coast-line, the area occupied by them lying throughout on the seaward side of the sand-dune belt, but extending north and south over a distance of 160 miles. The stones have been found at various altitudes up to about 600 feet. Two theories have been tentatively put forward to account for their occurrence in their present positions. Mr. H. Merensky considers that a series of cretaceous strata have been disintegrated, largely by wind action, leaving the diamonds and the associated pebbles as a small residuum of the original mass. On the other hand, Mr. H. Lotz points to the constant association of the diamonds with small banded agates, commonly cast up by the sea along this stretch of coast, and he suggests that both have been brought down from the basin of the Vaal by the Orange river. Dr. Range does not agree entirely with either of these views. He points out that no Kimberlite or other eruptive rock, such as might have formed the matrix for the diamonds, is known to exist in the region, and that the sea must almost certainly have been the means of transport to the present localities. But it does not appear that agates similar to those found on the south-west coast occur on the Vaal river; while, had the diamonds been derived from the latter locality, there would surely have been some trace of them along the course of the Orange river. He thinks that the diamonds were derived from the denudation of formations originally existing along the coast (probably west of its present position), and since covered by the sea. Since their discovery the monthly yield of the diamond fields has steadily risen, and during the first half of 1909 reached a total of 200,000 carats. Dr. Range considers that the results have exceeded expectation, and that the fields will support a prosperous industry for a number of years.

AMERICA.

Swiss Scientific Expedition to Colombia.—We are informed that a scientific expedition to Colombia is being organized at Neuchâtel, under the auspices of the Société Helvétique des Sciences Naturelles, the leader being Dr. O. Fuhrmann, professor of zoology at Neuchâtel University. It is hoped that a start will be made in July next, and the main objects kept in view will be the study of the fauna of the lakes and rivers of Central Colombia, as well as the parasitic flora, but geological and geographical observations are also contemplated. Dr. Fuhrmann will be accompanied, as botanist, by Dr. Mayor, of Neuchâtel. The Magdalena will be ascended from Baranquilla to Puerto Berrio, whence the party will proceed to Medellin. From this and other centres excursions will be made to various parts of the central Cordillera and the region of the Cauca, the travellers afterwards turning their attention to the Paramos of the eastern Cordillera, and making excursions in various directions from Bogotá. Halts will also be made later at Honda and Puerto Berrio, during the return journey to the coast.

Height of Mount Huascaran.—Mrs. Bullock Workman sends the following communication: "In July last Mrs. F. Bullock Workman sent a party of expert engineers, under direction of the Société Générale d'Etudes et de Travaux Topographiques of Paris, to Peru to make a reliable triangulation of the height of the two peaks of Mount Huascaran. The head of the mission, M. de Larminat, specially chosen for the work by Messrs. Fr. Schrader and Henri Vallot, has returned, and rendered his preliminary report to Mrs. Bullock Workman, which is as follows: 'The altitude of the north summit of Huascaran, claimed to have been climbed by Miss Peck, of U.S.A., and estimated by her at 24,000 feet, was found to be 21,812 feet. The height of the south summit works out at 22,187 feet.'* The final calculations, which are now being gone over by M. Vallot for verification, may show a variation of a few feet. The full report of the results will be submitted later."

Standard Time for Chile.—It is announced that Chile has now followed the example lately set by Peru (*Journal*, vol. 32, p. 533), and has adopted, as standard time for the whole Republic, that of the 75th meridian west of Greenwich, or five hours later than Greenwich time. This has everything in its favour from the point of view of practical convenience, as, besides agreeing with the time of Chile's northern neighbour, it is also the time of the eastern United States. It so happens, however, that the 75th meridian passes almost entirely outside Chilean territory, the only parts intersected by it being the peninsula of Taytao and some of the islands lying off the much-dissected southern portion of the coast-line.

AUSTRALASIA AND PACIFIC ISLANDS.

The Mountain Flora of Fiji is described by Miss L. S. Gibbs in the *Journal of the Linnean Society* (Botany), vol. 39, Nos. 270 and 271, on the basis of collections made by her in 1907 during a residence at the Government station of Nadarivatu, in the north of Viti Levu, not far from the culminating point of the island. The author begins with a general sketch of the physical features of the island, and prints the rainfall observations made by Mr. Joske at Nadarivatu during the years 1901–7. This shows a large variation from year to year, the total fall reaching 163·32 inches in 1901, but only 66·38 in 1903. There is a well-marked dry season lasting from July to October. Climatically, the island may be divided into two main divisions—the windward or south-east portion, including the greater part of the area, with a heavy rainfall and vegetation of tropical luxuriance; and the leeward or north-west side, a narrow belt screened by the mountains from the moisture-bearing south-east trade. By collecting only in the higher grounds, Miss Gibbs was able to eliminate the widely distributed Indo-Malayan littoral flora and the "ethno-botanical" element, both widely distributed. The large number (40) of new species met with in one locality shows that our knowledge of the flora is still too imperfect to admit of definite conclusions as to its relationships, but the collection confirms its Indo-Malayan character (the comparatively low altitude restricting it in the main to forest types), whilst also emphasizing its relationships to the islands to the east—Samoa and Tonga, and to a less extent Tahiti. The relation of the flora to the topographical character of the various islands of this part of the Pacific is very marked. Thus the magnificent conifers of Fiji are absent from the smaller and less mountainous Samoa group, while the flat coral islands of the Tonga group are largely cultivated, Eua only, with its volcanic soil and heavy rainfall, approximating to Fiji in its flora. In

* Mr. C. R. Enock, in his book on Peru, gives the height as trigonometrically fixed at 22,180 feet, a close approximation to the above figure.

plant-dispersal between the islands, wind has played an important part, but the agency of man has been more powerfully operative than has been generally recognized. In Fiji alien weeds are legion, and if no official bar is placed on forest destruction, it bids fair to rival New Zealand in heterogeneous flora and sterile wastes. Among the new records from Fiji are *Melicytus ramiflorus*, widely spread in New Zealand, and also known from the Kermadecs, Norfolk island, and Tonga; *Cyrtandra glabrata*, previously known only from Tahiti; *Podocarpus elatus*, one of the most important forest trees about Nadarivatu, known previously from Eastern Australia and New Caledonia; as well as forms belonging to the Indo-Malayan element. Among the new species is the handsome forest tree *Elæocarpus Kambi*.

Prof. R. Neuhauss in German New Guinea.—Prof. Neuhauss has communicated to the Berlin Geographical Society, of which he is a member, a short account of journeys carried out by him in 1908 and 1909, in German New Guinea, chiefly in the region of Huon gulf and the peninsula bounding it on the north. From Finsch haven, in company with Herr Keysser, a missionary, he went inland some 40 miles through a wild and rough mountain region traversed only by the hardly distinguishable paths of the natives, habitations of whom were found to an elevation of 4600 feet, the interior being much better peopled than has been supposed. The traveller collected material for an accurate map of Kai-land, the peninsula north of Huon gulf. In May and June, 1909, he ascended the Markham to a higher point than had previously been reached, finding it a well-defined stream, several hundred yards broad, and navigable for native canoes at least 60 miles from its mouth. At the time of writing the traveller was near the Dutch boundary, where he observed the effects of an earthquake that took place in 1907. For several miles the coast sank a considerable number of feet, palm trees and native dwellings being now covered by the sea.

Monument to Bougainville at Tahiti.—On July 14, 1909, a monument to the great French navigator was inaugurated, with appropriate formalities, at Papeete, on the island of Tahiti, which island he visited only a few months after its discovery by the English navigator Wallis. The proposal for the erection of the monument emanated from a French colonial official, a member of the Paris Geographical Society, by which body it was taken up with enthusiasm. The bust erected at Papeete was in part a copy of that in the possession of the Paris Society, but portraits preserved in the navigator's family were also utilized by the sculptor. The scheme received the support of the French Government as well as of the municipality of Papeete, and the ceremony of inauguration was opened by a speech by M. François, Governor of French Oceania. Two French and two British warships were present on the occasion.

POLAR REGIONS.

Peary and Cook.—In summarizing the North Polar narratives of Commander Peary and Dr. Cook in the October number of the *Journal* (vol. 34, p. 433), we expressly reserved all comment till fuller information should become available, adding that the final decision with respect to the claims of both explorers must await the examination of their scientific observations. Commander Peary, immediately after his return, submitted all his records for examination to the National Geographic Society of Washington, and the report of its sub-committee, the names of whose members speak for their competence, was published in the last number of the *Journal*. It is with pleasure that we are able to announce that Commander Peary will lecture on his expedition at a special meeting of the Society to be held in the Royal Albert Hall on May 4. On Dr. Cook's arrival in Copenhagen, he

announced that he had been obliged to leave his original records at Etah in charge of a fellow-countryman, Mr. Harry Whitney, who had been on a sporting trip to Greenland, but he promised at the earliest possible moment to submit to the University of Copenhagen a report which would fully substantiate his claim. After a delay of over two months, Dr. Cook despatched his promised report to the University of Copenhagen, and on December 21 the University Council announced the result of the examination of the report by the special committee appointed for the purpose. The copy of Dr. Cook's notebooks which had been sent to the university contained no astronomical records, but only results, and the committee stated that there were no elucidatory statements which might have rendered it probable that astronomical observations had really been taken. Nor were any practical details of the journey supplied such as would enable the committee to form an opinion relative to Dr. Cook's claim. The committee therefore considered that from the material submitted no proof could be adduced that Dr. Cook had reached the North Pole. Early in January it was reported that Dr. Cook's original notebooks had arrived in Copenhagen. On January 19, the Council declared that these notebooks were, in all essential particulars, identical with the copy on which the University based their judgment in the first instance. They find that the evidence submitted contains not the slightest proof that Dr. Cook reached the North Pole, nor, they state, is there any decisive proof to the contrary. The University, therefore, intends to take no steps at present with regard to the Honorary Degree conferred on Dr. Cook. A committee of the Explorers' Club, New York, appointed to examine Dr. Cook's claim to have ascended Mount McKinley in 1906, has drawn up a report unfavourable to the claim.

Amundsen's North Polar Expedition.—It is stated in *Petermanns Mitteilungen* that Captain Amundsen has modified his plans to the extent of postponing his departure from Norway till June of this year, and his final passage of Bering Strait till August, 1911, devoting most of the intervening period to oceanographical research in the South Atlantic during the outward voyage. He also proposes to carry out extensive investigations of the upper atmosphere during the drift across the Polar basin.

Government Grant to Captain Scott.—It is with great pleasure that we announce that Captain Scott has received a letter from the Treasury informing him that Parliament will be asked next session to vote a grant of £20,000 towards the cost of the South Polar Expedition which he is now engaged in organizing. In announcing his plans last autumn, Captain Scott estimated that their realization would involve a total expenditure of £40,000. Towards this amount there has now been subscribed and promised a sum of £31,000, including the Government grant. It will thus be seen that a sum of £9000 is still required to make up the minimum estimated cost of the expedition. No doubt as plans develop and work expands, Captain Scott will find that £40,000 is all too small a sum to meet his requirements. It is highly desirable that at least that amount should be subscribed in this country, leaving any grants which may come from the Australian and New Zealand Governments, in pursuance of the policy of generous assistance which has been followed by those countries in connection with the *Discovery* and *Nimrod* expeditions, to meet the excess of actual over estimated expenditure which is practically inevitable in such cases. It has been definitely decided to make Christchurch, New Zealand, the base of the expedition's operations.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Valley Tracks and Vegetation.—The above is the title of an article by Mr. G. F. Scott Elliot in the *Scottish Geographical Magazine* for August, 1909.

The phenomena dealt with are the formation of new land in river valleys and its fixation through the agency of colonizing plants. In the first place, the silt and sand brought down by rivers in the early "torrential" part of their course through woodland or peaty (moorland) regions is of a very mixed character, and is often of great fertilizing value—a fact made use of in Italy, where care is taken to deposit the silt of mountain streams on prepared surfaces to improve the character of the soil. If a river is selected and followed downstream, it is found that the width of the valley flats and the height of its banks gradually increase. The first stage in the formation of a river flat seems to be due to some rock-barrier downstream damming up the river when in flood, or, at any rate, interfering with the free passage of the flood-water. On the flooded lands beside the river, the water, being brought to rest, deposits its floating material, giving rise in summer to a rich growth of vegetation, which, by the following winter floods, is again covered with fine mud and sand. In this way a young holm, which may be covered by nothing but marsh and rush vegetation, will gradually develop into a hay meadow. It is, however, towards the river-mouth that the most important processes of land-formation are being actively carried on. When the silt-laden chocolate- or coffee-coloured water, passing straight down into the estuary, meets the constantly changing currents of the sea-water, its flow is checked, and as a consequence sand, and then mud, sinks and accumulates in an intricate series of submerged banks. In the Solway estuary the process is complicated by strong and irregular currents, and colonization by plants is rendered very difficult by the well-known "bore," or tidal wave. At considerable depths below high-water mark a certain amount of fixation may be effected by the Zostera banks, but from the shore the first visible sign of plant colonization is a faint greenish tinge, which can be easily perceived on the mud-banks exposed at low tide, and which is found to be due to the occupation of the banks by scattered plants of *Salicornia herbacea*, and green algæ like Enteromorphas. The top of these mud-banks may be readily colonized by a fairly dense population of *Salicornia*, which will, especially when assisted by a layer of gelatinous and coherent algæ, finally fix the banks. Should this *Salicornia* settlement connect with the shore, it will be invaded by the trailing runners of the grass *Glyceria maritima*, and the whole combination then forms an efficient sieve to retain all flotsam and silt. Then follow the beautiful silvery pink sheets of Armeria, and the associated plants like Triglochin, *Plantago maritima*, and *Aster Tripolium*. The Armeria flats, which are numerous in the Solway, afford valuable pasture for cattle and sheep, whose manure greatly improves the soil; and by the time they are firmly consolidated and above ordinary high tides, the Armeria plants become suppressed by rushes, sedges, grasses, and clovers, the land also becoming embanked and enclosed. The acquisition of new land by the Solway plants seem to be hindered by numerous irregular rivulets of fresh water, which greatly interfere with the growth of the Armeria flats.

OBITUARY.

H.M. King Leopold of Belgium.

By the death of H.M. Leopold II., King of the Belgians, the Society loses one of the small company of its honorary members. King Leopold was elected an honorary member in May, 1865, shortly before his accession to the throne. As Duke of Brabant he had displayed considerable love of travel, and carried out more than one extended tour in the Near and Far East. There is reason to believe

that at this time he had thoughts of seeking to establish a Belgian colony in the Eastern Archipelago. His accession to the throne at the end of 1865, at the age of thirty years, gave him other things to think of; but in the middle seventies, when the journeys of Livingstone and Stanley had aroused the interest of the civilised world in the opening up of Central Africa to a pitch of unparalleled enthusiasm, King Leopold took the lead in organizing what at first assumed the character of an international campaign for the exploration of the Dark Continent. In 1876 there was held at Brussels, on his invitation, an international conference, attended by, among others, Sir Bartle Frere, Sir Henry Rawlinson, Sir (then Mr.) William Mackinnon, Commander Cameron, Baron von Richthofen, Dr. Nachtigal, Dr. Schweinfurth, Herr Rohlfs, M. d'Abbadie, and M. Henri Duveyrier. The result was the formation of the International African Association, founded for the exploration and civilization of Central Africa. The delegates to the conference were not representative of their Governments, and the Association soon lost its international character. National committees were to have been appointed, and in some countries were appointed, to work in conjunction with the Association; but in England the Council of the Royal Geographical Society, which was invited to form the British committee, felt unable to take part in an enterprise of which the developments could not be foreseen, and instead the Royal Geographical Society started its African Exploration Fund for the despatch of independent British expeditions to Africa. The International Association sent out one or two expeditions, which were mainly Belgian in character, for the exploration of the interior from the east coast, but without much result. The return of Stanley in 1877, after his great journey across the continent, in which he descended the Congo river, gave a new turn to King Leopold's African ambitions. A Comité des Études du Haut Congo, the forerunner of the International Association of the Congo, was formed, and in 1879 an expedition was despatched under Stanley, who, after some preliminary work on the east coast, entered the mouth of the Congo, and proceeded upstream, establishing stations and entering into treaties with the native chiefs. From these beginnings, which marked the commencement of the modern partition of Africa, sprang the Congo Free State with King Leopold as independent sovereign. Into the subsequent history of the Congo Free State, until its annexation by Belgium as a Belgian colony in the autumn of 1908, this is not the place to enter. One result of King Leopold's death is the reversion to the Anglo-Egyptian Sudan of the Lado Enclave, the strip of territory along the left bank of the upper Nile north of Lake Albert, which was held on lease by King Leopold under agreements with the British Government of May, 1894, and May, 1906.

Colonel George Earl Church.

We regret to announce the death of Colonel George Earl Church, one of the foremost authorities on the history and geography of South America, and for some years a member of the Council and Vice-President of the Royal Geographical Society. Colonel Church was born on December 7, 1835, at New Bedford, Massachusetts, and to the end of his life remained a citizen of the United States. He was the first and only Fellow of the Society not a British subject to be elected a member of the Council. On his father's side, he was directly descended from Richard Church, who settled in Massachusetts in 1632, and on his mother's side not only traced his descent from a daughter of Edward Winslow, who sailed in the *Mayflower* and was three times governor of the New Plymouth Colony, but was connected with the Pease family of Yorkshire. He was educated as a civil engineer, and, after being engaged on various public works, including the Hoosac tunnel,

obtained an appointment under the Argentine Government in 1858 as a member of a scientific commission for the exploration of the south-western frontier of Argentina. The commission, which covered a distance of 7000 miles in nine months, had many exciting adventures with the Indians, and on one occasion it was reported in Buenos Aires that Mr. Church had been captured and burned to death. Afterwards he was engaged first in the survey and then in the construction of the Great Northern railway of Buenos Aires, until, on the outbreak of the Civil War in the United States, he left the Argentine Republic to serve as a volunteer under the Federal Government. During the war he rose to the rank of colonel, and after its close was appointed special war correspondent of the *New York Herald* to visit Mexico, then in the throes of revolution against the Emperor Maximilian. Colonel Church has already published 'A Historical Review of Mexico and its Revolutions.' On his new mission, which had been arranged with the approval of the United States Government, he attached himself to the army of President Juarez, and shared the fortunes of the republican forces till the capture of Maximilian in 1867, experiencing many adventures, in some of which he barely escaped with his life.

After serving for a short while on the editorial staff of the *New York Herald*, Colonel Church was invited, on behalf of the Bolivian Government, to engage in the task of opening up Bolivia to trade by way of the river Amazon and its tributaries. Having once undertaken this task, Colonel Church threw himself into its accomplishment with characteristic energy, making frequent visits to Bolivia and the adjacent republics, and traversing long stretches of the remote interior. He obtained from Brazil a concession to construct a railway to avoid the falls of the Madeira river, and succeeded in enlisting considerable support for the project in this country. But the concession and the companies which were formed in connection with it became the subject of protracted legal proceedings, and eventually the enterprise had to be abandoned. For more than ten years Colonel Church's energies had been devoted to these attempts to promote the development of Bolivia's resources from the side of Brazil, and his acquaintance with South America was remarkably varied and extended. In 1880 he was appointed United States Commissioner to report on the affairs of Ecuador, and at the same time was entrusted by the English bondholders with the task of readjusting the foreign debt of that country. Making his headquarters at Quito, he carried out some interesting journeys in the direction of the Colombian frontier.

On the completion of this mission, Colonel Church took up his residence in London, which remained his home down to the time of his death. He was connected with various important railway undertakings both in North and South America, which continued to take him abroad from time to time. But he also devoted much time and attention to the affairs of the Royal Geographical Society and kindred scientific bodies. He had joined the Society in 1872, and was elected to the Council in 1898, holding office till 1901. In 1902 he was elected a Vice-President of the Society, and served in that capacity for five years, afterwards remaining a member of the Council till May, 1909. Colonel Church was a frequent contributor to the *Journal*, among his more important contributions being papers on "South America: An Outline of its Physical Geography" (vol. 17, p. 333); "Inter-Oceanic Communication on the Western Continent" (vol. 19, p. 313); and "The Acre Territory and the Caoutchouc Region of South-West Amazonia" (vol. 23, p. 596). The first-named paper was read in abstract at an evening meeting of the Society on February 25, 1901, and was intended to be the preliminary chapter of a great work on South America, which unhappily was never completed. In 1898 Colonel Church was President of the Geographical Section of the British Association at its Bristol meeting, and took as the subject of his presidential

address, "Argentine Geography and the Ancient Pampean Sea." The address, which was both illuminating and suggestive, and revealed a wide range of knowledge, was afterwards reprinted in the *Journal* (vol. 12, p. 386). Colonel Church's interest in the history of travel, as well as in modern enterprise, was shown by his presence on the Council of the Hakluyt Society. He was also a Fellow of the Royal Historical Society, and a member of the Royal Anthropological Institute. His death, after a long and painful illness, occurred on January 4.

Prof. Henry Hillyer Giglioli.

The death occurred at Florence on December 16 of Prof. Henry Hillyer Giglioli, Director of the Royal Museum of Natural History in that city, and an honorary corresponding member of the Royal Geographical Society. The son of a political refugee from Italy, who took up his residence in Edinburgh and there married a Scottish lady, Henry Giglioli was born in 1843. In later years his father returned to Italy, taking his family with him, but at the age of seventeen young Enrico was sent back to London by the Italian Government to study zoology, and at Huxley's lectures and the meetings of the Zoological Society he became acquainted with most of the leading English naturalists, with some of whom he maintained a life-long friendship. On his return to Italy, he was appointed assistant naturalist on the *Magenta*, a vessel of the Italian navy, commissioned by the Italian Government for a voyage of scientific exploration. Returning from this voyage, the young naturalist was appointed Professor of Zoology at Florence with charge of the Royal Natural History Museum. From then until the time of his death his reputation grew, until he came to be recognized as one of the leading zoologists in Europe. In particular he was an expert ornithologist. He was also much interested in ethnology, and formed a valuable private ethnological collection. From time to time he engaged in research expeditions, especially for the study of the Mediterranean sea and the Italian lakes. As the representative of the Italian Government and Italian scientific societies, he attended a large number of international congresses in various parts of the world. He was elected an honorary corresponding member of the Royal Geographical Society in 1876.

Lieut.-Colonel A. E. G. Watherston, C.M.G.

By the death of Colonel Watherston the Society loses an able and accomplished Fellow, and the public service a singularly competent officer. Colonel Watherston obtained a commission in the Royal Engineers in February, 1887, and after spending some years on regimental duty was appointed an instructor in surveying at the School of Military Engineering. In 1898 he was made assistant commissioner on the Anglo-Portuguese Boundary Commission in South-East Africa. He was next appointed British commissioner for the delimitation of part of the boundary between French territory and the Gold Coast. In July, 1901, he was given the post of Director of Surveys of the Gold Coast, and for the next four years the work of mapping the colony, especially in the matter of defining the concessions of the various gold-mining companies, showed his great business capacity. During this period, also, he carried out the duty of Chief Boundary Commissioner for the Gold Coast-Ivory Coast frontier.

In April, 1905, he was appointed Chief Commissioner of the Northern Territories of the Gold Coast. He threw himself heart and soul into the work of governing this great block of country, and was an ideal chief commissioner. He did not,

however, escape the penalty of a long residence in a newly administered, remote, and unhealthy region. He suffered several times from black-water fever, but with characteristic pluck he kept to his work.

The Empire owes much to pioneer explorers and administrators of Colonel Watherston's type. Too often, it is to be feared, officials at home treat the risks incurred by such men as a matter of course. Too often men of courageous and self-reliant temper, who have incurred such risks, and have suffered from tropical illnesses, overestimate their powers of resistance.

To the grief of all those Fellows of our Society who knew him, Colonel Watherston died of fever at Tamale, in the Northern Territories of the Gold Coast, on December 12, 1909. C. F. C.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1908-1909.

RESEARCH DEPARTMENT.

December 16, 1909.—Dr. A. STRAHAN in the Chair.

"Changes in the Channel of the Trent." By Bernard Smith.
"Glaciation in New Zealand." By A. E. Kitson and E. O. Thiele.

Christmas Lecture, Monday, January 3, 1910.—"Travels in Bird-Land." By Richard Kearton.

Christmas Lecture, Friday, January 7, 1910.—"Across the High Carpathians." By the Rev. T. T. Norgate.

Sixth Meeting, January 10, 1910.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*Harry Spencer Scott Harden; Frank C. Laurie; Frederick L. Monsen; Erik Forsten Mystrôm; Arthur Thomas Purves; A. G. Stigand; Henry Coghlan White; William Young.*

COLONEL G. E. CHURCH.

The PRESIDENT said: Before proceeding to the business of the evening, I must ask your permission to allude to a great loss which the Society has sustained in the death of Colonel Church. He must have been known, I think, to everybody here present, as he so often took part in our meetings, discussing most frequently questions connected with South America. As you will have seen from the obituary notice in the papers, his life was a very eventful one, an exceedingly interesting one, and never an idle one. It is, however, rather as a colleague that I would speak of him to-night, than of his public career. In his death we have lost one who served as Vice-President on the Council for many years, and was always a wise councillor and a sincere friend.

The paper read was:—

"Travels of a Naturalist in South-West Africa." By Prof. H. H. W. Pearson.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Académie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (met.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Bosnia and Herzegovina. **Holbach.**

Bosnia and Herzegovina: some wayside wanderings. By Maude M. Holbach. London: J. Lane, 1910 [1909]. Size 7½ × 5, pp. 250. *Map and Illustrations. Price 5s. net. Presented by the Publisher.*

Balkan Peninsula—Karst. **Katzer.**

Karst und Karsthydrographie. Von D. Friedrich Katzer. ('Zur Kunde der Balkan-halbinsel,' herausgegeben von Dr. Carl Patsch, Heft 8.) Sarajevo: D. A. Kajon, 1909. Size 9 × 6, pp. iv. and 94. *Sketch-map, Sections, and Illustrations. Price* 2.50*m.*

Germany. **Colquhoun.**

1912? Germany and sea power. By Archibald R. Colquhoun. London: Sir I. Pitman & Sons, 1909. Size 7 × 5, pp. vi. and 120. *Sketch-maps. Price 1s. net. Presented.*

Germany—Brandenburg. **Friedel and Mielke.**

Landeskunde der Provinz Brandenburg. . . . herausgegeben von Ernst Friedel und Robert Mielke. Band I.—Die Natur. Von D. G. Schwalbe, Prof. Dr. E. Zache, Dr. P. Graebner und Prof. Dr. Karl Eckstein. Berlin: D. Reimer, 1909. Size 11 × 7½, pp. xvi. and 430. *Maps and Illustrations. Price 5s.*

Italy. **King and Okey.**

Italy to-day. By Bolton King and Thomas Okey. New edition. London: J. Nisbet & Co., 1909. Size 8½ × 5½, pp. xii. and 414. *Price 6s. net. Presented by the Publishers.*

Italy—Lakes. **Grieben.**

The Lakes of Northern Italy and Milan: a practical guide. (Grieben's Guide Books, vol. 124.) London: Williams & Norgate, 1909–10 [1909]. Size 6 × 4, pp. 154. *Maps and Plan. Price 3s. net. Presented by the Publishers.*

Italy—Vesuvius. **Stübel.**

Der Vesuv. Eine vulkanologische Studie für Jedermann. Von Alphons Stübel, . . herausgegeben von W. Bergt. (Veröffentlichungen des städtischen Museums für Länderkunde zu Leipzig.) Leipzig: M. Weg, 1909. Size 31½ × 10½, pp. iv. and 26. *Maps and Illustrations. Presented by Dr. W. Bergt (Director, Museum für Länderkunde, Leipzig).*

Switzerland—Valais. **Desbuissons.**

La vallée de Binn (Valais). Etude géographique, géologique, minéralogique et pittoresque. Par Léon Desbuissons. Lausanne: G. Bridel & Cie., 1909. Size 9½ × 6½, pp. viii. and 328. *Map, Illustrations, and Sections. Price* 10 *fr. Presented by the Author.*

Turkey—Albania. **Durham.**

High Albania. By M. Edith Durham. London: E. Arnold, 1909. Size 9 × 6, pp. xii. and 352. *Map and Illustrations. Price* 14*s. net. Presented by the Publisher.*

United Kingdom. **Buxton.**

By road and river: A descriptive geography of the British Isles. By E. M. Wilmot Buxton. London: Methuen & Co., [1909]. Size 7½ × 5, pp. viii. and 154. *Maps and Illustrations. Price* 2*s. Presented by the Publishers.*

United Kingdom. **Herbertson.**

The Oxford Geographies. Edited by A. J. Herbertson. The elementary geography: Vol. 2. In and about our own islands. By F. D. Herbertson. Oxford: Clarendon Press, 1909. Size 7½ × 5, pp. 112. *Maps and Illustrations. Price* 1*s. Presented by the Publishers.*

United Kingdom—Gloucestershire. **Evans.**

Cambridge County Geographies (edited by F. H. H. Guillemard). Gloucestershire. By Herbert A. Evans. Cambridge: University Press, 1909. Size 7½ × 5, pp. x. and 156. *Maps and Illustrations. Price* 1*s.* 6*d. Presented by the Publishers.*

United Kingdom—Kent. **Whitaker and others.**

Memoirs of the Geological Survey: England and Wales. The Water-supply of Kent, with records of sinkings and borings. By William Whitaker. With contributions by H. Franklin Parsons, Hugh Robert Mill, and J. C. Thresh. London, 1908. Size 10 × 6, pp. vi. and 400. *Map. Price* 8*s.* 6*d. Presented by the Geological Survey.*

Dr. Mill's note on the rainfall was referred to in the *Journal* for May last (p. 594).

United Kingdom—Middlesex. **Jerrold.**

Highways and Byways in Middlesex. By Walter Jerrold. London: Macmillan & Co., 1909. Size 8 × 5, pp. xviii. and 400. *Illustrations. Price* 6*s. Presented by the Publishers.*

United Kingdom—Midlands. **Fox-Strangways.**

Memoirs of the Geological Survey: England and Wales. The Geology of the Leicestershire and South Derbyshire coalfield. By C. Fox-Strangways. London, 1907. Size 10 × 6, pp. vi. and 374. *Map, Plans, and Sections. Price* 6*s. Presented by the Geological Survey.*

United Kingdom—Scotland. *P.R.I.* **18** (1909): 657–676. **Chrystal.**

Seiches in the Lakes of Scotland. By Prof. George Chrystal. *Illustrations and Diagrams.*

United Kingdom—Scotland—Lakes. **Chrystal.**

An Investigation of the Seiches of Loch Earn by the Scottish Lake Survey. Part III. Observations to determine the Periods and Nodes. Part IV. Effect of Meteorological Conditions upon the Denivellation of Lakes. Part V. Mathematical Appendix on the Effect of Pressure Disturbances upon the Seiches in a Symmetric Parabolic Lake. By Prof. Chrystal. (From the *Transactions of the Royal Society of Edinburgh*, vol. 46, pt. iii., 1908.) Edinburgh, 1908. Size 12 × 9½, pp. 455–517. *Diagrams.*

Noticed in the November number.

United Kingdom—South Wales. *Quart. J. Geol. S.* **65** (1909): 281–350. **Davis.**

Glacial Erosion in North Wales. By Prof. William Morris Davis. *Sketch-map and Diagrams.*

See note in the number for July, 1909, p. 83.

United Kingdom—Staffordshire. **Gibson.**

Memoirs of the Geological Survey: England and Wales. The geology of the North Staffordshire coalfields By Walcot Gibson. London, 1905. Size 10 × 6, pp. viii. and 524. *Maps, Illustrations, and Sections. Price* 6*s. Presented by the Geological Survey.*

United Kingdom—Tipperary. **Hill and others.**

P.R. Irish A. 27 (1909): Sect. B, 235–268.

The Mitchelstown caves, co. Tipperary. By Charles A. Hill, Harold Brodrick, and Alexander Rule. *Plans and Illustrations.*

Summarized in the Monthly Record, December, 1909, p. 676.

United Kingdom—Wiltshire. **Bradley.**

Cambridge County Geographies (edited by F. H. H. Guillemard). Wiltshire. By A. G. Bradley. Cambridge: University Press, 1909. Size 7½ × 5, pp. xii. and 156. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. Presented by the Publishers.*

ASIA.

Asia—Text-book. **Herbertson.**

The Oxford Geographies. Edited by A. J. Herbertson. The Elementary geography. Vol. 4, Asia. By F. D. Herbertson. Oxford: Clarendon Press, 1909. Size 7½ × 5, pp. 128. *Maps and Illustrations. Price* 1*s.* 6*d. net. Presented by the Publishers.*

Ceylon. **Parker.**

Ancient Ceylon: an account of the aborigines and of part of the early civilisation. By H. Parker. London: Luzac & Co., 1909. Size 10 × 6, pp. xiv. and 696. *Sketch-maps and Illustrations. Price* 25*s. net. Presented by the Publishers.*

China. **Kemp.**

The face of China: travels in East, North, Central, and Western China; with some account of the new schools, universities, missions, and the old religious sacred places of Confucianism, Buddhism, and Taoism. The whole written and illustrated by E. G. Kemp. London: Chatto & Windus, 1909. Size 9½ × 6½, pp. xvi. and 276. *Map and Illustrations. Price* 20*s. net. Presented by the Publishers.*

China. **Liddell.**

China: its marvel and mystery. By T. Hodgson Liddell, B.B.A. London: G. Allen & Sons, 1909. Size 10 × 7½, pp. xiv. and 204. *Illustrations. Price* 21*s. net. Presented by the Publishers.*

China—Historical. **Eames.**

The English in China: being an account of the intercourse and relations between England and China from the year 1600 to the year 1843 and a summary of later developments. By James Bromley Eames. London: Sir I. Pitman & Sons, 1909. Size 8½ × 5½, pp. xii. and 622. *Map, Plan, and Illustrations. Price* 20*s. net.*

Chinese Turkestan—Archæology. **Pelliot.**

La mission Pelliot en Asie centrale. (*Annales de la Société de Géographie Commerciale*, Section Indo-chinoise, Fasc. 4.) Hanoi, 1909. Size 11 × 7½, pp. viii. and 48. *Map. Presented by M. Paul Pelliot.*

Eastern Asia. **Austin.**

A scamper through the Far East, including a visit to Manchurian battlefields. By Major Herbert H. Austin. London: E. Arnold, 1909. Size 9 × 5½, pp. xvi. and 336. *Maps and Illustrations. Price* 15*s. net. Presented by the Publisher.*

India. **Cox.**

My thirty years in India. By Sir Edmund C. Cox. London: 1909. Molls & Boon. Size 9 × 5½, pp. xii. and 306. *Illustrations. Price* 8*s. net. Presented by the Publishers.*

India. **Curzon.**

The place of India in the Empire; being an address delivered before the Philosophical Institute of Edinburgh by Lord Curzon of Kedleston. London: J. Murray, 1909. Size 8½ × 5½, pp. 46. *Price* 1*s. Presented by the Publisher.*

India—Burma. **Sturdza.**

En Birmanie: souvenirs de chasse et de voyage. Par le Prince Grégoire Sturdza. Paris: Libr. Plon, 1909. Size 10 × 7, pp. 286. *Map and Illustrations. Presented by the Author.*

India—Eastern Bengal and Assam. **Cooch Behar.**

Thirty-seven years of big-game shooting in Cooch Behar, the Duars, and Assam. A rough diary by the Maharajah of Cooch Behar. London: R. Ward, Ltd., 1908. Size 9½ × 7½, pp. xxviii. and 462. *Map and Illustrations. Price* 21*s. net. Presented by the Publisher.*

India—Himalaya. **Workman.**

Peaks and glaciers of Nun Kun: a record of pioneer exploration and mountaineering in the Punjab Himalaya. By Fanny Bullock Workman and William Hunter Workman. London: Constable & Co., 1909. Size 9½ × 6½, pp. xvi. and 204. *Map and Illustrations. Price* 18*s. net. Presented by the Publishers.*

India—Sikkim and Bhutan. **White.**

Sikhim and Bhutan, twenty-one years on the North-East frontier, 1887–1908. By J. Claude White. London: E. Arnold, 1909. Size 10½ × 7, pp. xx. and 332. *Map and Illustrations. Price* 21*s. net. Presented by the Publisher.*

See review, *ante*, p. 182.

India and Ceylon. **Murray.**

A handbook for travellers in India, Burma, and Ceylon. . . . Seventh edition. London: John Murray, 1909. Size 7 × 4½, pp. cxvi. and 528. *Maps, plans, and Illustrations. Price* 20*s. Presented by the Publishers.*

Mainly a reprint of the fifth edition (itself thoroughly revised), but brought up to date, and with some additional matter.

Malaya. **Wolff.**

Im malaiischen Urwald und Zinngebirge. Von Dr. Wilhelm Wolff. Berlin: A. Schall, [1909]. Size 9½ × 6½, pp. x. and 240. *Illustrations. Price* 5*m.*

Describes the author's travels in Sumatra and in Siamese and British Malaya.

Russia—Siberia. *Le tour du Monde* 15 (1909): 313–384. **Labbé.**

Avec les Lamas de Sibérie. Par Paul Labbé. *Sketch-map and Illustrations.*

Russia—Siberia—Ethnology. **Bogoras.**

The Jesup North Pacific Expedition. Vol. 7. The Chukchee. By Waldemar Bogoras. Leyden and New York, 1904–09. Size 14 × 11, pp. xviii. and 734. *Sketch-map and Illustrations. Price* 37 *fl.* 50.

Russian Central Asia. *National G. Mag.* 20 (1909): 749–760. **Huntington.**

Life in the Great Desert of Central Asia. By Ellsworth Huntington. *Illustrations.*

Russian Central Asia. *Annuaire géol. et min. Russie* 12 (1910): 19–26. **Ivchenko.**

Schluchten auf dem Plateau Ischokusu. Von Alexander Iwtschenko. *Illustrations and Sections.* [In Russian and German.]

Turkey—Asia Minor. **Townshend.**

A military consul in Turkey: the experiences and impressions of a British representative in Asia Minor. By Captain A. F. Townshend. London: Seeley & Co., 1910 [1909]. Size 9 × 5½, pp. 328. *Illustrations. Price* 16*s. net. Presented by the Publishers.*

Western Asia. **Benn.**

An overland trek from India by side-saddle, camel, and rail: the record of a journey from Baluchistan to Europe. By Edith Fraser Benn. London: Longmans, Green & Co., 1909. Size 9 × 6, pp. xvi. and 344. *Map and Illustrations. Price* 15*s. net. Presented by the Publishers.*

AFRICA.

Belgian Congo—Administration. **Morel.**

Great Britain and the Congo: the pillage of the Congo basin. By E. D. Morel. London: Smith, Elder & Co., 1909. Size 8 × 5, pp. xxvi. and 292. *Maps. Price* 6*s. net. Presented by the Publishers.*

East Africa—Forestry. **Hutchins.**

East Africa Protectorate. Report on the Forests of British East Africa. By D. E. Hutchins. London: Wyman & Sons, 1909. Size 13 × 8½, pp. 144. *Maps and Illustrations. Price* 2*s.* 5*d.*

Egyptian Sudan—"Sudd." **Deuerling.**

Die Pflanzenbarren der afrikanischen Flüsse, mit Berücksichtigung der wichtigsten pflanzlichen Verlandungserscheinungen. Von Dr. Oswald Deuerling. (*Münchener G. Studien* (*Günther*) 24 (1910): pp. 254.) *Map and Illustrations.*

See review in the present number, p. 184.

German East Africa—Ethnology. **Weule.**

Native life in East Africa: the results of an ethnological research expedition. By Dr. Karl Weule. London: Sir I. Pitman & Sons, 1909. Size 9 × 6, pp. xxiv. and 432. *Map and Illustrations. Price* 12*s.* 6*d. net.*

Morocco. **Harris.**

With Mulai Hafid at Fez: behind the scenes in Morocco. By Lawrence Harris. London: Smith, Elder & Co., 1909. Size 8 × 5, pp. xvi. and 270. *Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

North Africa—Historical. **Piquet.**

Victor Piquet. Les civilisations de l'Afrique du Nord: Berbères, Arabes, Turcs. Paris: A. Colin, 1909. Size 7½ × 5, pp. x. and 396. *Sketch-maps. Price 4 fr. Presented by the Publisher.*

Rhodesia. **Hone.**

Southern Rhodesia. By Percy F Hone. London: G. Bell & Sons, 1909. Size 9 × 5⅝, pp. xvi. and 406. *Maps and Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

South Africa. **Cana.**

South Africa from the Great Trek to the Union. By Frank R. Cana. London: Chapman & Hall, 1909. Size 9 × 6, pp. x. and 340. *Maps. Price 10s. 6d. net. Presented by the Publishers.*

South Africa—Administration. **Brand.**

The union of South Africa. By the Hon. R. H. Brand. Oxford: Clarendon Press, 1909. Size 9 × 5½, pp. 192. *Price 6s. net Presented by the Publishers.*

South Africa—Ethnography. **Anderson and Stanley**

T. Geol. S. South Africa 12 (1909): 54–66.

Some remarks on the intimate relations between archæology and geology in South Africa; with a description of caves containing human and other mammalian remains on the farms Wonderfontein and Rooipoort, Potchefstroom district. By William Anderson and Prof. G. H. Stanley. *Plans*

South Africa—Minerals. **Johnson.**

The ore deposits of South Africa. By J. P. Johnson. Part II. London: Crosby, Lockwood & Son, 1909. Size 8½ × 5½, pp. vi. and 52. *Sketch-map and Sections. Price 5s. net. Presented by the Publishers*

South Africa—Phytogeography. **Marloth.**

Das Kapland, insonderheit das Reich der Kapflora, das Waldgebiet und die Karroos, pflanzengeographisch dargestellt von Dr. Rudolf Marloth. (*W. Ergebnisse "Valdivia"-Expedition*, 1898–99 (*Chun*) 2 (1908) 3 Teil, pp. 436.) *Maps and Illustrations.*

West Africa. **Simpson.**

West Africa. Report by Prof. W. J. Simpson on Sanitary Matters in various West African Colonies and the Outbreak of Plague in the Gold Coast Colony. London: Wyman & Sons, 1909. Size 13 × 8½, pp. 130. *Maps, Plans, and Illustrations. Price 9d.*

West Africa—Historical. **Avelot.**

L'Afrique Occidentale au Temps des Antonins. Par le Capitaine R. Avelot. (Extrait du *Bulletin de Géographie historique et descriptive*, No 1–2, 1908.) Paris, 1909. Size 10 × 6½, pp. 48. *Sketch-maps. Presented by the Author.*

A discussion of Ptolemy's Geography of West Africa (see p. 79 of this volume).

Tripoli. **Furlong.**

The gateway to the Sahara: observations and experiences in Tripoli. By Charles Wellington Furlong. London: Chapman & Hall, 1909. Size 8½ × 5½, pp. xxvi. and 306. *Sketch-maps and Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

Zambesi—Victoria Falls. *Quart. J. Geol. S.* 65 (1909): 390–407. **Codrington.**

Some Notes on the Neighbourhood of the Victoria Falls (Rhodesia). By Thomas Codrington. *Sketch-map, Section, and Illustration.*

Zanzibar.

Africa. No. 4 (1909). Despatch from His Majesty's Agent and Consul-General at Zanzibar, furnishing a Report on the Administration, Financial, and General condition of the Zanzibar Protectorate. London: Wyman & Sons, 1909. Size 13 × 8½, pp. 54.

NORTH AMERICA.

Labrador. **Robinson.**

In an unknown land: a journey through the wastes of Labrador in search of gold. By Edward Colpitts Robinson. London: E. Stock, 1909. Size 7½ × 5, pp. xii. and 154. *Illustrations. Price* 3*s. net. Presented by the Publisher.*

Mexico—Yucantan. **Arnold and Frost.**

The American Egypt: a record of travel in Yucatan. By Channing Arnold and Frederick J. Tabor Frost. London: Hutchinson & Co., 1909. Size 9½ × 6, pp. xiv. and 392. *Map, Plans, and Illustrations. Price* 16*s. net.*

See review, *ante*, p. 189.

North America—Birds. **Chapman.**

Camps and cruises of an ornithologist. By Frank H. Chapman. London: Hodder & Stoughton, [1909]. Size 9 × 6, pp. xvi. and 432. *Illustrations and Sketch-map. Price* 12*s. net.*

United States. [*U.S.*] *Bureau of Census, B.* 101 (1909): pp. 82. ——

Industrial Districts: 1905. Manufactures and Population. *Sketch-maps.*

United States—California. **Lawson and others.**

The California Earthquake of April 18, 1906. Report of the State Earthquake Investigation Commission. By Andrew C. Lawson. Vol. 1. Washington: Carnegie Institution, 1908. Size 11½ × 9, pp. xvii. and 452. *Maps, Illustrations, and Sections; also separate Atlas* (size 24 × 19). *Price* $17. *Purchased.*

United States—Colorado Desert. *National G. Mag.* 20 (1909): 681–701. **Mendenhall.**

The Colorado Desert. By W. C. Mendenhall. *Illustrations.*

United States—Hudson River. **Johnson.**

The picturesque Hudson. By Clifton Johnson. London: Macmillan & Co., 1909. Size 7 × 4½, pp. xiv. and 228. *Illustrations. Price* 5*s. net. Presented by the Publishers.*

United States—Illinois. ——

Chemical and Biological Survey of the waters of Illinois. Report from September 1, 1906, to December 31, 1907. Edward Bartow, Director. (From the *University of Illinois Bulletin*, vol. 6, No. 4, 1908.) Urbana, 1908. Size 9 × 6, pp. 88. *Illustrations and Diagrams.*

United States—New York. **Rensselaer.**

History of the city of New York in the seventeenth century. By Mrs. Schuyler van Rensselaer. 2 vols. New York: The Macmillan Co., 1909. Size 9 × 6, pp. (vol 1) xxviii. and 534; (vol. 2) xii. and 640. *Facsimile Map and Plan. Price* 24*s. net.*

United States—New York. **Rensselaer.**

New York State Library. Van Rensselaer Bowier Manuscripts; being the letters of Kiliaen van Rensselaer, 1630–1643, and other documents relating to the colony of Rensselaerswyck. Translated and edited by A. J. F. van Laer. (Ninetieth Annual Report on the New York State Library, vol. 2.) Albany, 1908. Size 2 × 5½, pp. 910. *Facsimile map and Illustrations.*

Refers to Dutch settlements in the neighbourhood of Albany.

United States—North-West. *National G. Mag.* 20 (1909): 645–663. **Darton.**

Our Pacific North-west. By W. H. Darton. *Illustrations.*

CENTRAL AND SOUTHERN AMERICA.

Bolivia and Peru—Boundary. **Ballivian.**

El laudo argentino: inaceptable para Bolivia, inconveniente para el Perú. Por Adolfo Ballivian. La Paz, 1909. Size 10½ × 7, pp. 110. *Maps. Presented by the Author.*

Brazil. **Vallentin.**

In Brasilien. Von Dr. W. Vallentin. Berlin: H. Paetel, 1909. Size 9½ × 6½, pp. viii. and 256. *Illustrations. Price* 4*s.*

Travels in various parts of Brazil, with a view to studying the economic conditions, etc.

Brazil—Amazon. **Highams.**

Across a continent in a man-of-war; being the Log of Commission of H.M.S. *Pelorus*, 1906–1909. With a full account of her cruise of 2000 miles up the Amazon. By E. E. Highams. London: Westminster Press, 1909. Size 7½ × 5, pp. xvi. and 240. *Illustrations. Price 5s. net.*

Colombia and Panama. **Cortes and Arosemena.**

B. Mints. Relac. Exteriores Columbia **2** (1909): 426–432.

Tratado entre las Repúblicas de Columbia y de Panamá. Par Enrique Cortes et C. C. Arosemena.

This is referred to in the Monthly Record for November, 1909.

Guatemala—Earthquake. **Ascoli.**

Mem. Manchester Philos. S. **53** (1908–09): No. 23, pp. 8.

The Guatemala Earthquake and Eruption of 1902. By W. S. Ascoli. *Illustrations.*

Panama and Ecuador. **Festa.**

Dr. E. Festa. Nel Darien e nell' Ecuador: diario di viaggio di un naturalista. Turin: Unione Tip.-Editrice, 1909. Size 10 × 7, pp. xvi. and 398. *Maps and Illustrations. Price* 10 *lire. Presented by the Author.*

Peru. *Appalachia* **12** (1909): 34–45. **Douglass.**

The Crescentic Dunes of Peru. By A. E. Douglass. *Diagram and Illustrations.*

Peru. **Wright.**

The old and the new Peru: a story of the ancient inheritance and the modern growth and enterprise of a great nation. By Marie Robinson Wright. Philadelphia (London: C. S. Cazenove & Son), [1908]. Size 12½ × 10, pp. 456. *Map and Illustrations. Presented by Señor E. Lembeke, Peruvian Chargé d'Affaires.*

Salvador and Costa Rica. **Peña.**

Viajes por la Costa del Pacífico. De San Salvador á Costa Rica. Par José Maria S. Peña. San Salvador, 1909. Size 7 × 5, pp. 70. *Presented by the Author.*

South America—River Plate. *Scottish G. Mag.* **25** (1909): 469–481. **Christison.**

The River Plate Region forty-three years ago. By Dr. David Christison. *Illustrations.*

West Indies—Cuba. **Berchon.**

Conférence sur l'Ile de Cuba. Par Charles Berchon. Bordeaux, 1909. Size 10 × 6½, pp. 24. *Presented by the Author.*

AUSTRALASIA AND PACIFIC ISLANDS.

Dutch New Guinea. *Ts. K. Nederlandsch Aard. Genoots.* **26** (1909): 793–800. **Goossen.**

Land en volk van Zuid Nieuw-Guinea. Naar A. J. Goossen.

The writer commanded the recent survey party (*Journal*, vol. 34, p. 688).

Fiji—Flora. *J. Linnean S. (Botany)* **39** (1909): 130–212. **Gibbs.**

A Contribution to the Montane Flora of Fiji (including Cryptogams), with Ecological Notes. By Lilian S. Gibbs. *Sketch-map and Illustrations.*

Noticed, *ante*, p. 199.

German New Guinea. *Deutsches Kolonialblatt* **20** (1909): 739–745. ——

Eine Fahrt auf den Kaiserin Augustafluss.

Summarized in the October number, p. 458.

German New Guinea—Admiralty Islands. ——

Deutsches Kolonialblatt **20** (1909): 895–900.

Eine Strafexpedition nach den Admiralitäts-Inseln.

New Caledonia and New Hebrides. *Le tour du Monde* **15** (1909): 193–216. **Myrica.**

De la Nouvelle-Calédonie aux Iles Hébrides. Par Pierre de Myrica. *Sketch-map and Illustrations.*

New Mecklenburg. *G.Z.* **15** (1909): 425–450. **Sapper.**

Neu-Mecklenburg. Von Karl Sapper.

New South Wales. *Records Geol. Surv. New South Wales* **8** (1909): 321–334. **Harper.**

Notes on the Physiography and Geology of the North-eastern Watershed of the Macquarie River. By L. F. Harper. *Sketch-map, Plan, and Sections.*

New Zealand—Historical. **McNab.**

Murihiku: a history of the South Island of New Zealand and the islands adjacent and lying to the South, from 1642 to 1835. By Robert McNab. Wellington and London: Whitcombe & Tombs, 1909. Size 8½ × 5½, pp. xvi. and 500. *Facsimile Charts and Illustrations. Price 15s. Presented by the Publishers.*

New Zealand—Western Otago. **Park.**

New Zealand Geol. Surv. B. No. 7 (1909): pp. x. and 112.

The Geology of the Queensland Subdivision, Western Otago Division. By James Park. *Maps, Plans, Sections, and Illustrations.*

Pacific Islands. **Walker.**

Wanderings among South Sea savages, and in Borneo and the Philippines. By H. Wilfrid Walker. London: Witherby & Co., 1909. Size 9 × 6, pp. xvi. and 256. *Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Papua. **Mackay.**

Across Papua. Being an account of a voyage round, and a march across, the territory of Papua, with the Royal Commission. By Colonel Kenneth Mackay. London: Witherby & Co., 1909. Size 9 × 5½, pp. xvi. and 192. *Map and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

POLAR REGIONS.

Antarctic—Enderby Land. **Zirkel and Reinisch.**

Untersuchung des vor Enderby-Land gedredschten Gesteinmateriales. Von F. Zirkel und R. Reinisch. (*W. Ergebnisse "Valdivia" Expedition*, 1898–99 (*Chun*) 10 (1905): 35–44.) *Illustrations.*

Antarctic—Glaciation. *Z. Gletscherkunde* 3 (1909): 321–334. **Nordenskjöld.**

Einige Beobachtungen über Eisformen und Vergletscherung der antarktischen Gebiete. Von Otto Nordenskjold.

Antarctic—Graham's Land. *Meteorologische Z.* 26 (1909): 337–347. **Woeikoff.**

Klima von Snow-Hill, Grahamland, nach den Beobachtungen der schwedischen Südpolarexpedition. Von A. Woeikow.

Antarctic—Shackleton Expedition. **Shackleton.**

The Heart of the Antarctic: being the story of the British Antarctic Expedition, 1907–1909. By E. H. Shackleton, C.V.O. With an introduction by Hugh Robert Mill, D.SC., an account of the first journey to the South Magnetic Pole, by Prof. T. W. Edgeworth David, F.R.S. 2 vols. London: W. Heinemann, 1909. Size 10 × 7, pp (vol. 1) xlviii. and 372; (vol. 2) xvi. and 420. *Maps and Illustrations. Price 36s net Presented by the Publisher.*

Arctic—Expedition. *Nineteenth Century* 66 (1909): 586–597. **Harrison.**

A Plea for a British Arctic Expedition. By Alfred H. Harrison.

Arctic—Meteorology. *Met. Z.* 26 (1909): 145–164. **Alt.**

Die Doppelozillation des Barometers, insbesondere im arktischen Gebiete. Von E. Alt. *Sketch-maps and Diagrams.*

Arctic—North Pole. *Mouvement G.* 26 (1909): 421–431. ———

Le Dr. Frederic Cook au pôle Nord. *Portrait and Map.*

Polar Expeditions. *Nature* 81 (1909): 338–340. **[Reeves.]**

Polar Expeditions and Observations.

Polar Exploration. ———

Recent Polar Exploration. (From the *Edinburgh Review*, No. 430, October 1909.) London: Longmans, Green & Co., 1909. Size 8½ × 5½, pp. 473–497.

Polar Regions. **Nordenskjöld.**

Die Polarwelt und ihre Nachbarlander. Von Otto Nordenskjöld. Leipzig, etc.: B. G. Teubner, 1909. Size 9½ × 6½, pp. viii. and 220. *Illustrations and Sketch-map. Price 8m. Presented by the Publisher.*

Polar Regions. **Nordenskjöld.**

Die praktische Verwertung der Polarlander und die Spitzbergenfrage. Von Prof. Otto Nordenskjöld. (Sonderabdruck aus *Deutsche Revue*, April, 1909.) Stuttgart, 1909. Size 9½ × 6, pp. 10.

Spitsbergen—King Karl's Land. Gothan.
K. Svenska Vetenskaps-A. Handl. 43 (1909): No. 10, pp. 42.
Die fossilen Hölzer von Kong Karls Land. Von Dr. W. Gothan. *Illustrations.*

MATHEMATICAL GEOGRAPHY.

Altitudes. *Sitzb. K. Preuss. A.W. Berlin*, 1908: 492–511. Helmert.
Trigonometrische Höhenmessung und Refraktions-Koeffizienten in der Nähe des Meeresspiegels. Von F. R. Helmert.

Determination of position. Schwarzschild and Birck.
Tafeln zur astronomischen Ortsbestimmung im Luftballon bei Nacht, sowie zur leichten Bestimmung der mitteleuropäischen Zeit an jedem Orte Deutschlands . . . herausgegeben von Prof. Dr. K. Schwarzschild und Dr. O. Birck. Göttingen: Vandenhoeck & Ruprecht, 1909. Size 9½ × 8½, pp. 12. *Maps and Diagram. Price* 4*s.*

Longitudes. *M. k.k. Militärg. J.*, 28 (1908): 49–57. Andres.
Längenunterschiedmessungen zweiter Ordnung. Vorläufige Mittellung von Leopold Andres. *Diagram.*
The longitude differences in question were determined by telegraph in the neighbourhood of Vienna.

Measurement of Areas. Gray.
The polar planimeter: how it is used, and how it operates. A simple treatise by Frank J. Gray. London: St. Bride's Press, [1909]. Size 7 × 5, pp. viii. and 58. *Diagrams. Price* 1*s. net. Presented by the Author.*

Navigation. Williamson.
Text-book of navigation and nautical astronomy. By Capt. A. P. W. Williamson. London, etc.: J. Griffin & Co., 1909. Size 9½ × 5½, pp. vi. and 388. *Charts and Diagrams. Price* 7*s.* 6*d. net. Presented by the Publishers.*

Surveying. Pelkington.
Co-ordinate geometry applied to land-surveying. By Woodford Pelkington. London: E. & F. N. Spon, 1909. Size 6½ × 4, pp. 44. *Diagrams. Price* 1*s.* 6*d. net. Presented by the Publishers.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Atmospheric Electricity. *Terrestrial Magnetism* 13 (1908): 119–128. Dike.
Report on the Atmospheric Electricity Observations made on the Magnetic Survey Yacht *Galilee*, 1907–08. By P. H. Dike.

Denudation. *American J. Sc.* 27 (1909): 349–368. Leverett.
Weathering and Erosion as Time Measures. By Frank Leverett. *Sketch-maps.*

Earth-movements. *XI. Jbericht G. Ges. Greifswald*, 1907–08 (1909): 17–37. Braun.
Ueber Bodenbewegungen. Von Dr. Gustav Braun. *Diagram.*

Earthquakes. *N. American Phil. S.* 43 (1909): 235–258. Hovey.
Earthquakes: their causes and effects. By Edmund Otis Hovey.

Geological History. *Sits. K.A.W. Wien*, 1. Abt. 117 (1908): 513–518. Höfer.
Das polynesische alteozäne Festland. Von H. Höfer.

Geology. Chamberlin and Salisbury.
Geology: shorter course. By Thomas C. Chamberlin and Rollin D. Salisbury. London: J. Murray, 1909. Size 8 × 5, pp. xviii. and 978. *Maps, Sections, and Diagrams. Price* 21*s. net. Presented by the Publisher.*

Geology—Flints. Carus-Wilson.
The pitting of Flint surfaces. By Cecil Carus-Wilson. Teddington, 1909. Size 8 × 5½, pp. 9. *Illustrations. Presented by the Author.*
The writer ascribes the pitting to the freezing of the water absorbed.

Geomorphology. Suess.
Das Antlitz der Erde. Von Eduard Suess. III. Band, 2. Hälfte (pp. 790). Namens- und Sachregister für sämtliche Bände von Eduard Suess' Antlitz der Erde, bearbeitet von Dr. Lukas Waagen (pp. 158). Vienna: F. Tempsky (Leipzig: G. Freytag), 1909. Size 11 × 8. *Maps, Sections, and Illustrations. Price (Volume and Index)* 50*m. Presented by the Publisher.*

Oceanography. *B.I. Océanog. Monaco*, No. 143 (1909): pp. 4. **Marini.**

Quelques considérations sur le programme pour l'Exploration internationale de l'Océan Atlantique et de la Méditerranée. Par S. Marini.

Oceanography. **Wedderburn.**

Dr. O. Petterson's observations on deep-water oscillations. By E. M. Wedderburn. (Reprint from *Proceedings of the Royal Society of Edinburgh*, vol. 29, Part 6.) Edinburgh, 1909. Size 10 × 7, pp. 602–606. *Sketch-map and Diagram.*

Oceanography—Drift-currents. *Ann. Hydrographie* 36 (1908): 481–484. **Ekman.**

Zur Frage von der Ablenkung der Triftströmungen. Von V. Walfrid Ekman.

Oceanography—Fauna. **Herdman.**

Our food from the waters. By Prof. W. A. Herdman. (Evening Discourse, British Association, Winnipeg, 1909.) [London, 1909.] Size 8½ × 5½, pp. 10.

Oceanography—Fauna. **Hjort.**

Conseil. Perm. Explor. de la mer. Rapports et Proc.-Verb. x. (1909): pp. 862.

Rapport sur les Travaux de la Commission A dans la période 1902–1907. (Rapporteur le Dr. Johan Hjort.) *Charts and Diagrams.*

Oceanography—Fauna. **Koehler.**

Résultats des Campagnes Scientifiques accomplies sur son yacht, par Albert 1er Prince Souverain de Monaco. Fasc. xxxiv. Échinodermes provenant des campagnes du yacht *l'Princesse-Alice* (Asteries, Ophiures, Échinides et Crinoides). Par R. Koehler. Monaco, 1909. Size 14 × 11½, pp. 318. *Plates.*

Oceanography—North Atlantic. **Hjort.**

Report on Norwegian fishery and marine investigations. Vol. 2 (2 parts). Edited by Johan Hjort. Bergen: J. Grieg, 1909. Size 10½ × 7½. *Charts, Diagrams, and Illustrations. Presented by the Scientific Laboratory of the Administration of the Norwegian Fisheries.*

Includes memoirs by various writers, the titles of which are entered separately in this list.

Oceanography—North Atlantic. **Wolfenden.**

Memoirs of the Challenger Society, No. 1. Scientific and biological researches in the North Atlantic, conducted by the author on his yachts the *Walwin* and the *Silver Belle* By R. Norris Wolfenden. London: Rebman, Ltd, 1909. Size 11½ × 8½, pp. vi. and 234. *Map, Illustrations, and Sections. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Oceanography—South-West Pacific. *Ann. Hydrographie* 36 (1908): 477–481. ——

Ozeanographische Arbeiten S.M.S. *Planet* im Bismarck-Archipel 1907, unter dem Kommando von Kapitanleutnant Kurtz. Von D. S.

Oceanography—Voyage. **Chun.**

Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer *Valdivia*, 1898–1899. Im Auftrage des Reichamtes des Innern herausgegeben von Carl Chun. II. Band, 1 Teil (pp. 1–406) and 3 Teil (pp. 436); and X. Band, Lfgn. 1–3 (pp. 1–76). Jena: G. Fischer, 1905–08. Size 13½ × 10. *Maps and Illustrations. Presented by the Imperial Foreign Office, Berlin.*

Oceanography—Voyage. **Lütgens.**

Vorläufiger Bericht über eine ozeanographische Forschungsreise. Von Dr. Rudolf Lütgens. (Sonderabdruck aus 'Annalen der Hydrographie und Maritimen Meteorologie,' 1909.) Berlin, 1909. Size 11 × 8, pp. 145–153. *Sketch-map, Illustration, and Diagrams.*

This voyage and its results were referred to in the January number (p. 84).

Terrestrial Magnetism. *Terrestrial Magnetism* 14 (1909): 57–66. ——

The Magnetic Survey Yacht *Carnegie* and Her Work. *Illustration, Portraits, and Plans.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography—Migrations. **Scott-Elliot.**

The Migration of Man. By Prof. G. F. Scott-Elliot. (Extracted from the *Transactions of the Dumfriesshire and Galloway Natural History and Antiquarian Society*, vol. 19.) N.P., [1909]. Size 8½ × 5½, pp. 16. *Presented by the Author.*

Ethnology. **Haddon.**

The races of man and their distribution. By Dr. A. C. Haddon. London: Milner & Co., [1909]. Size 7½ × 5, pp. x. and 126. *Illustrations. Price* 1*s. net. Presented by the Publishers.*

Historical. **Speight and Nance.**

Britain's Sea-Story, B.C. 55—A.D. 1805. Being the story of British heroism in voyaging and sea-fight from Alfred's time to the Battle of Trafalgar. With an Introduction tracing the development of the structure of sailing ships from the earliest times. Edited by E. E. Speight and R. Morton Nance. (3rd edit.) London: H. Frowde and Hodder & Stoughton, 1909. Size 8 × 5½, pp. xiv. and 428. *Illustrations. Price* 5*s. Presented by the Publishers.*

Historical—Anson. **Cash.**

Anson's voyage round the world, 1740 1744. Selections, edited by C. G. Cash. London: A. Rivers, Ltd., 1909. Size 7 × 5, pp. xvi. and 152. *Sketch-map and Portrait. Price* 1*s.* 3*d. net. Presented by the Publishers.*

Historical—Place-names. **Graesse and Benedict.**

Orbis latinus, oder Verzeichnis der wichtigsten lateinischen Orts- und Ländernamen. Von Dr. J. G. Th. Graesse . . . 2 Auflage . . neu bearbeitet von Friedrich Benedict. Berlin: R. C. Schmidt & Co., 1909. Size 10 × 6½, pp. vi. and 348. *Price* 10*m.*

A new edition, with considerable additions, of Graesse's valuable dictionary of Latin place-names, the chief attention being given to non-classical writers.

Historical Geography. *B. American G.S.* **41** (1909): 422–439. **Semple.**

The Operation of Geographic Factors in History. By Ellen Churchill Semple.

BIOGRAPHY.

Credner. *XI. Jahresber. G. Ges. Greifswald*, 1907–08 (1909): vii.-xxi. **Jaekel.**

Zum Gedächtnis Rudolf Credners. Von Prof. Dr. O. Jaekel. *Portrait.* Schriftverzeichnis von Rudolf Credner. Von Dr. H. Runge.

Darwin. *Deutsche Rundschau G.* **31** (1909): 433-443. **Ule.**

Darwin's Bedeutung in der Geographie. Von Willi Ule.

Lawes. **King.**

W. G. Lawes of Savage Island and New Guinea. By the Rev. Joseph King. London: The Religious Tract Society, 1909. Size 8½ × 5½, pp. xxvi. and 388. *Portraits, Map, and Illustrations. Price* 5*s. net. Presented by the Publishers.*

McCormick. **Casson.**

Cyrus Hall McCormick: his life and work. By Herbert N. Casson. Chicago: A. C. McClurg & Co., 1909. Size 8½ × 5½, pp. xii. and 264. *Portraits and Illustrations. Presented by the Author.*

The subject of this memoir was a pioneer of the industrial era in the United States.

Stanley. **Stanley.**

The autobiography of Sir Henry Morton Stanley, G.C.B. Edited by his wife, Dorothy Stanley. London: Sampson Low, Marston & Co., 1909. Size 9½ × 6, pp. xviii. and 552. *Portraits, Map, and Illustrations. Price* 21*s. net. Presented by the Publishers. Also copy of Edition-de-luxe, presented by Lady Stanley.*

GENERAL.

Bibliography—Ptolemy's Geography. **Stevens.**

Ptolemy's Geography: a brief account of all the printed editions down to 1730, with notes on some important variations observed in that of Ulm 1482, including the recent discovery of the earliest printed map of the world yet known on modern geographical conceptions in which some attempt was made to depart from ancient traditions. By Henry N. Stevens. 2nd edit. London: H. Stevens, Son, & Stiles, 1908. Size 9 × 6, pp. viii. and 62. *Presented by the Author.*

British Empire. **Barker.**

Great and Greater Britain. The problems of Motherland and Empire; political, naval, military, industrial, financial, social. By J. Ellis Barker. London: Smith,

Elder & Co., 1909. Size 8½ × 5½, pp. xii. and 380. *Price* 10*s.* 6*d. net. Presented by the Publishers.*

Education—Text-book. **Miller.**

Practical geography for secondary and supplementary schools. By James and William Miller. London: G. Bell & Sons, 1909. Size 7½ × 5, pp. viii. and 116. *Sketch-maps and Diagrams. Price* 2*s. Presented by the Publishers.*

German Colonies. **Schneider.**

Jahrbuch über die deutschen Kolonien. Herausgegeben von Dr. Karl Schneider. I. und II. Jahrgänge. Essen: G. D. Baedeker, 1908–1909. Size 9 × 6, pp. (I. Jg.) viii. and 208; (II. Jg.) viii. and 212. *Maps and Portraits. Price* 5*s. each.*

Handbook. **Scobel.**

Geographisches Handbuch. Allgemeine Erdkunde, Länderkunde und Wirtschaftsgeographie . . . Herausgegeben von A. Scobel. 5 . . . Auflage. II. Band. Bielefeld and Leipzig: Velhagen und Klasing, 1910. Size 10½ × 7, pp. xiv and 816. *Maps, Illustrations, and Diagrams. Price* 10*m. Presented by the Publishers.*

Paradox. **Palermo.**

La terra sensibile e cosciente. Di Antonio Palmermo. Milan: L. F. Cogliati, 1909. Size 10 × 6½, pp. 102. *Presented by the Author.*

OLDER WORKS ADDED TO THE LIBRARY AND MAP COLLECTION IN 1909.

Abella y Casariego, Enrique—Descripción física, geológica y minera en bosquejo de la Isla de Panay; *and* Torremotos experimentados en la isla de Luzón durante los mezes de Marzo y Abril de 1892, especialmente desastrosos en Pangisanán, Unión y Benguet. (Publicaciónes oficiales.) *Maps, Diagrams, and Illustrations. Presented by the Bureau of Science, Manila, P.I.* *Manila*, 1890–93.

Cortes, Martin.—The Art of Navigation. Contayning a briefe description of the Spheare with the partes and Circles of the same, as also the making and use of certaine instruments. Very necessarie for all sortes of Sea-men to understand. First written by Martin Curtis [*sic*], and translated by Richard Eden. *Maps, Diagrams, and Volvelles.* Size 7 × 5½. *Presented by Sir Henry Bulwer.* *London*, 1596

Ebel, D. J. G. Die neuen Strassen durch den Kanton Graubündten, in dreyssig Blattern . . . dargestellt . . von J. J. Meyer *Map and Illustrations.* Size 8½ × 11. *Zürich*, 1825.
[From the Holzmann Library.]

Fale, Thomas—Horologiographia. The art of dialling Teaching an easie and perfect way to make all kinds of Dials upon any plaine plat howsoever placed. . . . *Diagrams.* Size 7 × 5½. *Presented by Sir Henry Bulwer.* *London*, 1627.
[Bound in one volume with Cortes' 'Art of Navigation,' *supra.*]

Gruner, Gottlieb Sigmund.—Die Eisgebirge des Schweizerlandes. 2 vols. *Maps and Illustrations.* Size 8 × 5. *Bern*, 1760.
[From the Holzmann Library].

[Houtman, Cornelis]—Eerste Schip-vaert, Gedaen van de Hollanders naer Oost-Indien met vier Scheepen, onder't Beleydt van Cornelis Houtman, Uyt Texel t'Zeyl gegaen, Anno 1595. Verhalende al't gedenck waerdighste dat haer op de Reys is voorgevallen te Water en te Lande, als oock de Conditien, Religien, Zeden en Huys-houdingen der Indiaensche Volckeren, de Vruchtbaerheydt van't Aerdtrijck, de Natuer en verscheydenheyt der Beesten en Vogelen, ende voorts de Koopmanschappen en andere Vreemdicheden der Landen en Steeden die sy gesien en beseylt hebben. *Illustrations.* Size 7½ × 6. *Presented by Sir Henry Bulwer.* *Amsterdam*, [1598].
[From the Amherst Library].

James, Thomas.—The Strange and Dangerous Voyage of Captaine Thomas James, in his intended Discovery of the North-west Passage into the South Sea. *Map in facsimile, presented by Mr. H. N. Stevens.* Size 7½ × 5½. *London*, 1633.
[As purchased, this copy contained the map, by Ralph Hall, belonging to John Dunton's 'True Journal of the Sallee Fleet, 1636.' (See Churchill's Collection, vol. 3.)]

Le Roy, P. L.—Relation des aventures arrivées à quatre matelots russes, jettés par une tempête près de l'Isle déserte d'Ost-Spitzbergen, sur laquelle ils ont passé six ans et trois mois. . . . Size 6 × 6. *Presented by Sir Clements Markham.*
[*Paris*], 1766.

Leslie, John.—De origine, moribus, et rebus gestis Scotorum: Libri decem. E quibus septem, veterum Scotorum res in primis memorabiles contractius, reliqui vero tres, posteriorum Regum ad nostra tempora historiam, quæ hucusque desiderabatur, fusius explicant. Size 8½ × 6½. *Map.* *Romæ*, 1578.

Lowndes, William Thomas.—The Bibliographer's manual of English literature. . . . New edition. 6 vols. (in 11). Size 7½ × 4½. *London*, 1857–64.

Ludolphus de Suchen [Ludolph von Sudheim].—Descriptio terræ sanctæ et itineris ejus Hierosolymitani. Size 6½ × 5. *Presented by Sir Clements Markham.*
Venice, [*c.* 1490].

[Malaspina and others].—Viaje político-científico alrededor del mundo por las corbetas Descubierta y Atrevida, al mando de los Capitanes de Navío D. Alejandro Malaspina y Don José de Bustamente y Guerra desde 1789 á 1794. Publicado. . . . por D. Pedro de Novo y Colson. *Map and Illustrations.* Size 13 × 9½.
Madrid, 1885.

Martyr, Peter.—De orbe novo, Petri Martyris Anglerii [*sic*]. . . . Decades octo, diligenti temporum observatione, et utilissimis annotationibus illustræ, suóque nitori restitutæ, Labore et industria Richardi Hakluyti Oxoniensis. . . . *Map.* Size 7 × 4. *Presented by Sir Henry Bulwer.* *Paris*, 1587.
[From the Amherst Library.]

Merian, Matthæus.—Topographia Helvetiæ, Rhætiæ, et Valesiæ: Das ist, Beschreibung und Diligentliche Abbildung der Vornembsten Stätte und Plätz in der hochlöblichen Eydgenossschaft Grawbundten, Wallis, und etlicher zugewandten Orten. *Maps, Plans, and Illustrations.* Size 12½ × 8½. *Frankfurt*, 1642.
[From the Holzmann Library.]

Minutoli, Heinrich Freiherr von.—Reise zum Tempel des Jupiter Ammon in der Libyschen Wüste und nach Ober-Aegypten, in den Jahren 1820 und 1821. Size 11 × 9: *Separate Atlas of Illustrations*, size 25 × 19. *Also* 'Nachträge.' . . . [to above work]. *Illustrations.* Size 8 × 5. *Berlin*, 1824–27.

Muller, G. F.—Voyages et découvertes faites par les Russes le long des côtes de la Mer Glaciale et sur l'Océan Oriental, tant vers le Japon que vers l'Amérique. . . . 2 vols. *Map.* Size 6½ × 6. *Amsterdam*, 1766.

Rajal y Larré, Joaquin.—Exploración del territorio de Davao (Filipinas). Size 9½ × 6½. *Presented by the Real Sociedad Geográfica, Madrid.* *Madrid*, 1891.

Robson, Joseph.—An account of six years' residence in Hudson's Bay, from 1733 to 1736, and 1744 to 1747. . . . *Plans.* Size 8 × 5. *London*, 1752.

Roggeveen, Jacob.—Dagverhaal der Ontdekkings-Reis van M. Jacob Roggeveen met de Schepen 'Den Arend,' 'Thienhoven,' en de 'Afrikaansche Galei,' in de jaren 1721 en 1722. . . . Uitgegeven door het Zeeuwsch Genootschap der Wetenschappen. *Map and Illustrations.* Size 9 × 5½. *Middelburg*, 1838.

Schlagintweit, Hermann von.—Reisen in Indien und Hochasien. . . . 4 vols. *Maps and Illustrations.* Size 9 × 6½. *Jena*, 1869–80.

Topley, William.—The geology of the Weald (parts of the counties of Kent, Surrey, Sussex, and Hants). Geological Survey Publication. *Maps, Illustrations, and Sections.* Size 10 × 6½. *London*, 1875.

Velasco, Juan López de.—Geografía y descripción universal de las Indias, publicada. . . . por Justo Zaragoza. Size 9½ × 6½. *Presented by the Real Sociedad Geográfica, Madrid.* *Madrid*, 1894.

Zuallardo, Giovanni.—Il devotissimo viaggio di Gerusalemme. . . . *Maps, Plans, and Illustrations.* Size 9 × 6. *Rome*, 1587.

Switzerland.—Beschreibung der Stadt und Republik Bern. . . . 2 parts. *Maps and Illustrations.* Size 7 × 4½. *Bern*, 1794–1496.
[From the Holzmann Library.]

Itinerariu(m) Germaniæ provincias continens, iis qui iter aliquo vel legationis, vel mercaturæ vel alia ex causa suscipiunt longe necessarium. *Presented by Sir Henry Bulwer.* [N.P., 1587?]
[From the Amherst Library.]

Scheuchzer, Johann Jacob. Nova Helvetiæ tabula geographica, 1712. (Second copy.)

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria-Hungary. **Artaria.**

Artaria's Eisenbahnkarte von Österreich-Ungarn mit Stationsverzeichnis. Vierte Neubearbeitung. X. Auflage. Scale 1:1,500,000 or 1 inch to 23·6 stat. miles. Vienna: Artaria & Co., 1910. *Price* 2.40 *kr.* *Presented by the Publishers.*

Austria-Hungary. **K. u. K. Militärgeographisches Institut, Vienna.**

Spezialkarte der österreichisch-ungarischen Monarchie. Scale 1:75,000 or 1 inch to 1·2 stat. miles. Sheets: 15-vi. Kufstein; 15-ix. Ischl und Hallstatt; 15-x. Liefen; 16-i. Hohenems; 16-v. Innsbruck und Achen-See; 16-viii. St. Johann im Pongau; 17-ii. Stuben; 17-v. Matrei; 17-vi. Hippach und Wildgerlos-Spitze; 17-vii. Grosz-Glockner; 17-viii. Hof-Gastein; 18-iv. Sölden und St. Leonhard; 18-v. Sterzing und Franzensfeste; 18-vi. Bruneck; 18-vii. Lienz; 18-viii. Möll Thal; 18-ix. Gmund und Spittal; 19-iii. Glurns und Ortler; 19-vi. Toblach und Cortina d'Ampezzo; 19-ix. Bleiberg und Tarvis; 19-x. Klagenfurt und Villach; 20-v. Bozen und Fleimsthal; 20-vi. Pieve und Longarone; 21-iii. Tione und M. Adamello; 21-vi. Belluno und Feltre; 22-iii. Storo; 22-v. Sette Comuni. Vienna; K. u. K. Militärgeographisches Institut, 1909. *Price* 1*m. each sheet.*

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from December 1 to 31, 1909.

4 miles to 1 inch:—

County diagram, showing civil parishes, with a table of their areas. Cornwall. *Price* 6*d.*

1-inch—(third edition):—

In Outline, 147. 1*s.* (engraved).
With hills in black or brown, 147. 1*s.* (engraved).
Towns and Country around or special districts.
Flat in sheets or folded in cover, with roads printed in colour:—
Sheffield and the Peak: parts of sheets 86, 87, 99, 100, 111, 112. Leicester: parts of sheets 141, 142, 155, 156, 169, 170. North Devon: sheets 276, 277, 293, and parts of 278, 292, 294.
With lakes and roads printed in colour:—
The Lake District: parts of sheets 23, 24, 29, 30, 38, 39, 48, 49. *Price, unmounted,* 1*s.* 6*d.*; *mounted,* 2*s. each.*
Large-sheet series, printed in colours, folded in covers or flat in sheets, 42, 73, 75, 76, 117, 125, 127, 136, 137, 145. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*; *mounted in sections,* 2*s.* 6*d. each.*

6-inch—County Maps:—

Hampshire, 8 sheets. **Kent,** 20 sheets. **Lancashire,** 3 sheets. **Yorkshire,** 8 sheets. *Price* 1*s. each.*

25-inch—County Maps:—

Cheshire, 9 sheets. **Hampshire,** 54 sheets. **Lancashire,** 4 sheets. **Sussex,** 26 sheets. **Yorkshire,** 103 sheets. *Price* 3*s. each.*

England and Wales. **Geological Survey.**

1-inch map:—

New Series, colour printed. Drift Edition, 72, 142. *Price* 1*s.* 6*d. each.*
(*E. Stanford, London Agent.*)

British Isles—Scotland. **Geikie.**

Geological map of Scotland, reduced chiefly from the Ordnance and Geological Surveys under the direction of Sir Archibald Geikie, K.C.B., D.C.L., F.R.S. Topography by John Bartholomew, F.R.G.S. Scale 1:633,600 or 1 inch to 10 stat. miles. Second edition, with Descriptive Text. Edinburgh: John Bartholomew & Co., 1910. *Price* 7*s.* 6*d. net.* *Presented by the Publisher.*

This is a new edition.

Denmark. **Kgl. Danske Sökort Arkiv.**

Kort udgivet af det Kongelige Danske Sökort-Arkiv. Nos.: 231, Bornholm med Omgivelser; 232, Guldborg-Sund, Nordlige Del. Copenhagen: Kongelige Danske Sökort-Arkiv, 1909. *Presented by the Danish Admiralty.*

France. **Immanuel.**

Uebersicht der Befestigungen und des Eisenbahnnetzes von Ost-Frankreich. Von Major Fr. Immanuel. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1909, Tafel 41. Gotha: Justus Perthes, 1909. *Presented by the Publisher.*

France. **Service Géographique de l'Armée, Paris.**

Carte de France. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheet XXV.–49, Port-Vendres. Paris: Service Géographique de l'Armée, 1909. *Price* 1.60 *fr. each sheet.*

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 139, Borkum; 140, Norden; 172, Emden; 337, Halberstadt; 387, Sondershausen; 388, Querfurt; 481, Hillesheim; 482, Mayen; 483, Coblenz; 505, Boppard. Berlin: R. Eisenschmidt, 1909. *Price* 1.50*m. each sheet.*

ASIA.

China. **Friquegnon.**

Carte de la Chine Orientale par le Commandant Friquegnon. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. 9 sheets. Hanoi: Service Geographique de l'Indo-Chine, 1908.

Although this is stated to be a map of Eastern China, it really includes a much wider area than would generally be understood by this title, and in fact extends considerably to the west of Koko Nor; while to the north it takes in a great part of Mongolia, and to the south the whole of Turkey and the north of Siam. A list of authorities consulted is given under the title, from which it will be seen that the surveys and route traverses of all important travellers have been utilized. The map, which is printed in colours, contains a large amount of detail, and care has been taken to distinguish by the style of lettering the relative importance of towns and villages, of which latter an unusual number are shown.

China. **Futterer.**

Holderer's u. Futterer's Expedition in Zentral-Asien 1898–1899. Sektion III. Prof. Dr. Karl Futterer's Routenaufnahme von Min-Tschôu bis Long-Kü-Tsai (Nordwestliches China) vom 1–31 Dezember 1898. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. 2 sheets. *Petermanns Mitteilungen*, Jahrgang 1909, Tafeln 42 u 43. Gotha: Justus Perthes, 1909. *Presented by the Publisher.*

Indian Government Surveys. **Surveyor-General of India.**

India and adjacent countries: scale 1 : 1,000,000 : 1 sheet, Persia; 1 inch to 1 mile: North-West Frontier Province, 5 sheets; Punjab, 3 sheets; Bombay, 4 sheets; Central Provinces and United Provinces, 8 sheets; Berar Central Provinces and Central India, 7 sheets; Bengal, 1 sheet; Eastern Bengal and Assam, 3 sheets; Burma, 16 sheets.—India, showing railways open and under construction on March 31, 1909, 1 inch to 80 miles.—Bengal Survey, 1 inch to 1 mile, 1 sheet.—Bombay Survey, 1 inch to 1 mile, 1 sheet.—Burma Survey, 1 inch to 1 mile, 6 sheets.—Central India and Rajputana Survey, 1 inch to 1 mile, 1 sheet.—United Provinces: Etah district, 1 inch to 4 miles.—United Provinces Survey, 1 inch to 1 mile, 3 sheets. Calcutta: Surveyor-General's Office, 1909. *Presented by the Secretary of State for India, through the India Office.*

Indo-China. **Gallois.**

Atlas General de l'Indo-Chine Française par Chabert L. Gallois. Hanoi-Haiphong: Imprimerie d'Extrême-Orient, 1909.

This is an interesting and instructive atlas of French Indo-China prepared from the most reliable official documents and surveys. It commences with a short account of the history of the cartography of the region from the earliest times, with facsimiles of the maps of Ptolemy A.D. 1490, Mercator 1538, Ribeiro 1529, Linschoten 1599, P. Alexandre de Rhodes 1650, P. Goos about 1666, and Robert de Vaugondy 1751. After this follow sixty-three plates containing numerous maps and plans of Indo-China as a whole, and separately of its five divisions, Chochurchina, Cambodia, Annam, Tonking, and Laos. The last section of the atlas contains maps of the provinces of China adjacent to French Indo-China. In addition to the maps themselves, relative areas and other statistical information is shown by diagrams. The maps are all printed in colour.

Indo-China—Laos. **Service Géographique de l'Indo-Chine.**

Carte des communications du Laos. Scale 1 : 750,000 or 1 inch to 11·8 stat. miles. 5 sheets. Hanoi: Service Géographique de l'Indo-Chine, 1908.

An outline sketch-map without hills, showing by colours and symbols projected and existing means of communication in the French territory south of Tongking and between the Mekong river and the coast. The extent of the navigability of rivers is also indicated.

Java. **Topographical Bureau, Batavia.**

Spoor en Tramwegkaart van Java en Madoera. Scale 1 : 1,000,000 or 1 inch to 15·7 stat. miles. 2 sheets. Batavia: Topographical Bureau, 1909.

A general map of Java in two sheets, printed in colours, showing means of communication up to date. Enlarged plans of Batavia, Sĕmarang, and Soerabaja are given as insets.

Manchuria.

Die südliche Mandschurei zum Verfolg der Operationen im russisch-japanischen Kriege. Scale 1 · 2,000,000 or 1 inch to 31·5 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1909, Tafel 45. Gotha: Justus Perthes, 1909. *Presented by the Publisher.*

AFRICA.

Uganda. **Geographical Section, General Staff.**

Uganda-Congo Commission, 1906–1908. Scale 1: 250,000. 4 sheets. London: Geographical Section, General Staff, 1909. *Price* 2*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

AMERICA.

Canada. **Dept. of the Interior, Ottawa.**

Standard Topographical map of Canada. Scale 1 · 250,000 or 1 inch to 3·9 stat. miles Sheet 9 SF Pembroke, Ontario, and Quebec. Ottawa: Department of the Interior, 1909. *Presented by the Department of the Interior, Ottawa.*

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet 74, Cross lake, revised to September 8, 1909. Ottawa. Department of the Interior, 1909 *Presented by the Department of the Interior, Ottawa.*

Canada. **Dept. of Militia and Defence, Ottawa**

Topographic map of Canada. Scale 1 . 63,360 or 1 inch to 1 stat. mile. Sheets: 21, Huntingdon, Ontario-Quebec; 22, Laval, Quebec; 23, Lachine, Quebec; 25, Vandreuil, Ontario-Quebec. Ottawa: Department of Militia and Defence. London: Geographical Section, General Staff, 1909 *Presented by the Director of Military Operations.*

United States. **Campbell.**

Kohlenfelder der Vereinigten Staaten Nach der Karte von Marius R. Campbell, U.S. Geological Survey. Scale 1: 12,500,000 or 1 inch to 197·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1909, Tafel 39. Gotha: Justus Perthes, 1909. *Presented by the Publisher.*

POLAR REGIONS.

Antarctic Regions. **Meinardus.**

Das antarktische Festland. Auf Stielers Handatlas No. 6 nach Bruce, Shackleton u. a. ergänzt von Prof. Dr. O. Meinardus. Scale 1: 40,000,000 or 1 inch to 631·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1909, Tafel 38. Gotha: Justus Perthes, 1909 *Presented by the Publisher.*

GENERAL.

German Colonies. **Sprigade and Moisel.**

Grosser deutscher Kolonialatlas. Bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben von Reichs-Kolonialamt. Ergänzungs-Lieferung 2. Kamerun. Berlin: Dietrich Reimer (Ernst Vohsen), 1909. *Presented by the Publisher.*

The supplementary parts of the German colonial atlas now being issued were noticed in the *Geographical Journal* for August last. The present sheets include the northern part of Kamerun from lat. 5° 25′ N. to Lake Chad.

Portuguese Colonies. **Ministerio da Marinha e Ultramar.**

Atlas Colonial Portuguès. 2a edição reduzida. Lisbon: Ministerio da Marinha e Ultramar. Commissão de Cartographia, 1909. *Presented by the Ministerio da Marinha e Ultramar, Lisbon.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during November, 1909. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 3753, Plans on the north coast of Norway: Gi sund, Tiel sund, northern portion, 3s. 150, France, south coast: Marseilles, 3s. 1286, Malacca strait: Penang harbour and approaches, 3s. 2991, China, Pechili gulf: Entrance to Liau river, including Newchang, Liau river above Newchang, 3s.

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic ocean, December, 1909. Washington: U.S. Hydrographic Office, 1909. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, February, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1909. *Presented by the U.S. Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, January, 1910. London: Meteorological Office, 1909. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, December, 1909, January and February, 1910. Washington: U.S. Hydrographic Office, 1909. *Presented by the U.S. Hydrographic Office.*

Indian Ocean and Red Sea. **Meteorological Office**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, January, 1910. London: Meteorological Office, 1909. *Price 6d. each. Presented by the Meteorological Office.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, January, 1910. Washington: U.S. Hydrographic Office, 1909. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, February, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1909. *Presented by the U.S. Weather Bureau.*

PHOTOGRAPHS.

China. **Davies.**

One hundred and six photographs of Ché-Chiang, China, taken by Major H. R. Davies, Oxfordshire Light Infantry. *Presented by Major H. R. Davies.*

Major Davies has already presented many photographs taken by him during his extensive travels in China to the Society. Those comprising the present set are of the east coast province of Ché-Chiang, and are carefully arranged and described in an album.

(1) Panorama of Ting-hai harbour; (2) Mouth of Ta-sung Chiang; (3) Inside Nimrod island, Nimrod sound; (4) Citadel hill, Chên-hai; (5) Yü-wang-sui (No-wang-sui), between Ch'uan-shan and Ning-po; (6) West end of Yü-wang Ling (No-wang Ling); (7) Looking west from west end of Yü-wang Ling; (8) View of Chên-hai harbour from Ta-chia-chi Shan; (9) The river at Chên-hai; (10) Descent from K'ung-shu-ling pass; (11) The Nan-ch'ang Hu, near Ning-po; (12) Typical scenery near Ning-po; (13) Typical scenery and hill near Ning-po; (14) Village near Ning-po; (15) Village house near Ning-po; (16) Temple near Ning-po; (17) Big house in village near Ning-po; (18) Ning-po ice-house; (19) Water-buffaloes; (20) The Yang Chiang at Ning-po; (21) Sepoy Sher Singh surveying on a grave; (22) Mosquito-wheel and Ning-po coolies; (23) Inside Shao-hsing Fu city; (24) and 25) Country near Shao-hsing Fu; (26) Hills near Tou-tien, north of Shao-hsing Fu; (27) Canal near Ta'ao-ê; (28) Cliffs of Niao-mên Shan, near Shao-hsing Fu; (29) Wheelbarrow at Ta-ao-ê; (30 and 31) Street in Shao-hsing Fu; (32) Fishy [illegible] Ch'uan-shang

Chiang, opposite Hang-chou; (33) View of Grand canal and settlement from British Consulate, Hang-chou; (34) West lake at Hang-chou, from the Ch'ien-t'ang Mên; (35) South-east end of West lake, Hang-chou; (36) South-west end of West lake, Hang-chou; (37) The Lei-fêng-t'a ("Thick" pagoda), Hang-chou; (38) The West lake, Hang-chou; (39) Temples on West lake; (40) European house on West lake; (41) Pass on the way from West lake to Cha-k'ou; (42) View near north suburb, Hang-chou; (43 and 44) View from the Ch'ien-t'ang Mên, Hang-chou; (45) The Ch'ien-t'ang Mên, Hang-Chou; (46) The Wu-lin-Mên water-gate, Hang-chou; (47) Front part of the Wu-lin Mên; (48) The Grand canal in the north suburb, Hang-chou; (49) Canal in Hang-chou city; (50) South wall of Hai-ning Chou; (51) Iron buffalo on sea-wall at Hai-ning Chou; (52) The Hai-ning Chou pagoda; (53–56) The tidal bore at Hai-ning Chou; (57) Kang-sêng-sau and British Consulate, Wên-chou; (58) The Hou Chiang at Wên-chou; (59) Wên-chou anchorage; (60 and 61) Three-span stone arch bridge in Hang-chou; (62) Stone bridge in Hang-chou; (63 and 64) One-span stone arch bridge; (65 and 66) Three-span stone slab bridge; (67) Bridge of boats at Ning-po; (68 and 69) One-span stone slab bridge; (70) Sea-going junk in Yung Chiang at Ning-po; (71 and 72) Sea-going junk in Yung Chiang at Chên-hai; (73 and 74) Ning-po houseboat; (75) Ferry-boat over Ts'ao-ê Chiang at Pai-kuan; (76) Sea-going junk at Pai-kuan; (77) River-boats at Pai-kuan; (78 and 80) Small boat near Ning-po; (79) Foot-boat; (81) Cargo-boat at Shao-hsing Fu; (82) Cargo-boat at Hang-chou; (83–85) Shao-hsing Fu houseboats; (86) Ch'ü-chou houseboat; (87) Lan-sh'i houseboat; (88) "Tobacco"-boat on Ch'ien-t'ang Chiang; (89) "Salt"-boat on Ch'ien-t'ang Chiang; (90) "Rice"-boats on Ch'ien t'an Chiang; (91) "Wood"-boat on Ch'ien-t'ang Chiang; (92–94 and 96–100) Boats going over a haulover; (95) Pulling small boat over haulover with boat-hooks; (101–106) Villages of Northern Ché Chiang.

East Africa Protectorate. **Ross.**

Two photographs of Mount Kenia, taken by W. McGregor Ross, Esq. *Presented by W. McGregor Ross, Esq.*

Two enlargements of excellent telephotographic views of the mountain.

(1) Mount Kenia, 17,040 feet, taken at a distance of twelve miles; (2) Mount Kenia at six miles range, looking south by west.

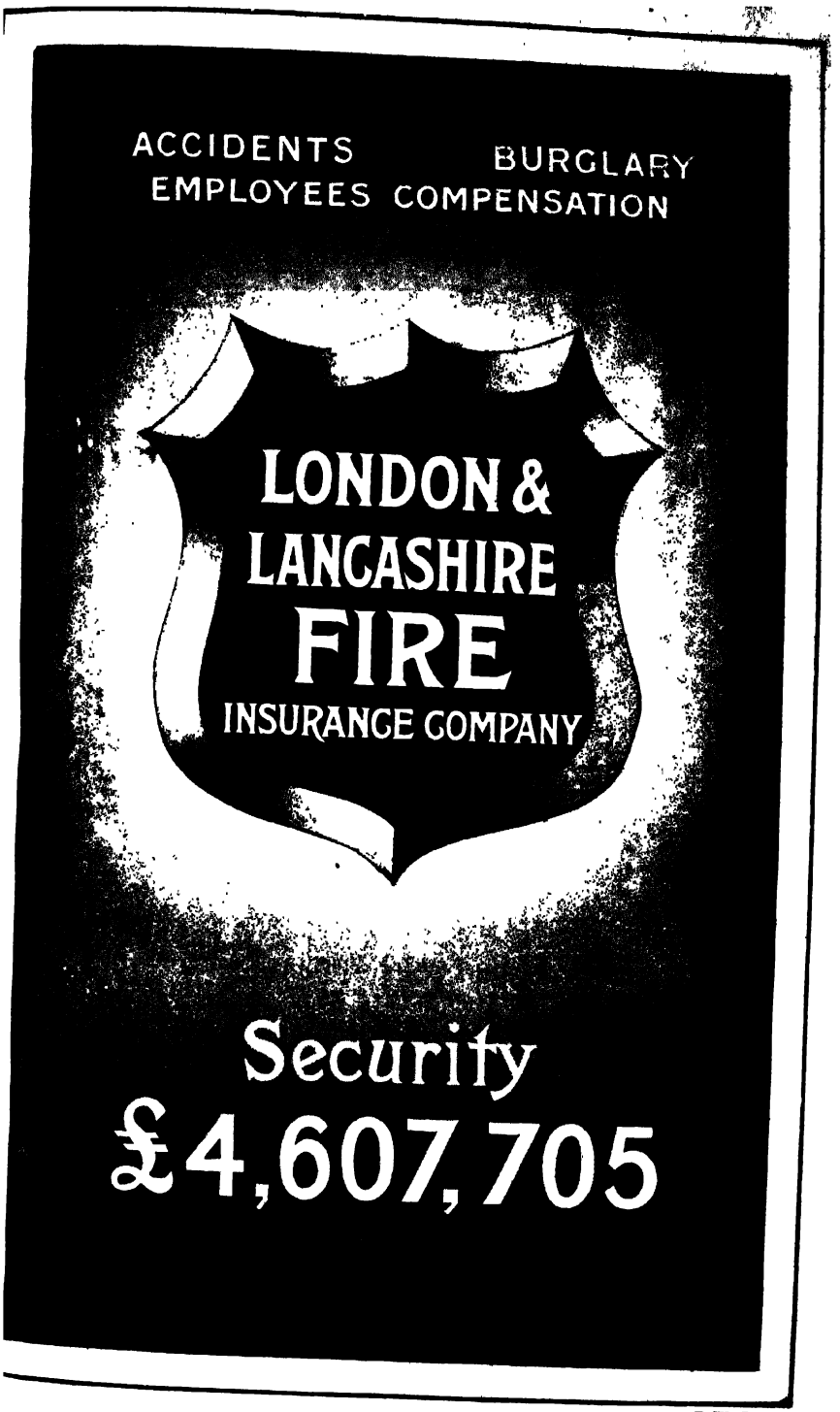
Kashmir and Chinese Turkestan. **Shuttleworth.**

Thirty-nine photographs of Hunza and Chinese Turkestan, taken by Captain A. R. B. Shuttleworth, I.A. *Presented by Captain A. R. B. Shuttleworth.*

Among this set are some good views of glacier and mountain scenery, but perhaps the most interesting are those showing methods of travel and crossing streams by means of improvised bridges.

(1) Mount Rakapushi; (2) Nilt, in Hunza valley; (3) Near Minnipin; (4) A bit of the polo ground at Baltit; (5) The Mirs palace, Baltit; (6) The lower terrace, Chin Bagh; (7) A bit of the road between Baltit and Gulmit; (8) A bit of the Hunza river near Baltit; (9) Suspension bridge over the Hunza river; (10) Pitching camp at Attabad; (11) A bit of the road at Gulmit; (12) Looking towards Pasu; (13 and 14) Temporary bridge, Pasu; (15) The Pasu glacier; (16) The Batur glacier; (17) Beyond Misgat; (18) My tent, Murkhushi, with Mintaka beyond; (19) Mintaka encampment, Taghdumbash Pamir; (20) Mintaka encampment under snow; (21) Paik, Taghdumbash Pamir; (22) Khirgis yort, Paik; (23) Tashkurgan; (24) Sarikoli and Kashgari, Tashkurgan; (25 and 26) Mustagh-ata from Tashkurgan; (27) Transport on the road between Tashkurgan and Tarbashi; (28) Climbing up the Darstart gorge; (29) Getting started, Tarbashi; (30) Moving off, Tarbashi; (31–33) Temporary bridge over Kintol; (34) Crossing the Kintol; (35) Main street, Yang-i-Hissar; (36) Bird's-eye view of Kashgar from the top of the western gate; (37) The Swedish Mission Hospital, Kashgar; (38) The Hazrat Apak, Kashgar; (39) The back of the British Consulate, Kashgar.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


ACCIDENTS
BURGLARY
EMPLOYEES COMPENSATION
LONDON &
LANCASHIRE
FIRE
INSURANCE COMPANY
Security
£4,607,705

P.T.O.



Fire :

Simple Contracts Latest Concessions

Consequential Loss :

Reimbursement of

Profits Standing Charges -

Increased Cost of Working

Accident

Increased Benefits Optional Schemes

Burglary Plate Glass

Fidelity Guarantee Third Party.

Boiler and Electrical Plant

Employees Compensation

Marine

Registered Post Passengers Baggage.

Specie Insurance Transit Risk

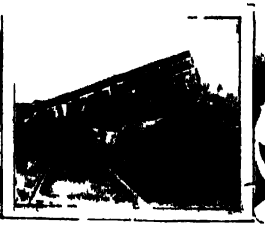
Send for latest terms etc to

London & Lancashire Fire Insurance Co.,

45 Dale Street Liverpool

76 King William Street E C

or any of its 40 Branches.



HOTEL MÉTROPOLE,

Northumberland Avenue, Trafalgar Square,

LONDON.



Of world-wide reputation. Conveniently situated, close to Houses of Parliament, Westminster Abbey, Government Offices, Theatres, fashionable quarters, and chief places of interest. Numerous luxuriously furnished suites of apartments. Most magnificent hotel lounge in London.

Telegrams: "Métropole, London."
Telephone: 6180 Gerrard (20 lines).

Gordon Hotels, Ltd.

AROSA.

GRISONS, SWITZERLAND.

6000 feet above Sea-level. Splendid Winter Resort. Recommended by the greatest Medical Authorities.

HOTEL SEEHOF. FIRST-CLASS HOTEL.

Finest situation in Arosa on the Lake. Specially adapted for English visitors during the winter season. Electric light and central heating throughout. New drawing-room and billiard-room with English and French billiards.

CURLING RINK IN FRONT OF THE HOTEL. SKI-ING, SKATING, AND TOBOGGANING.

PENSION, PRICE, 8-14 FRS

For Prospectus and all particulars apply to the proprietor—

Telegraphic Address—"SEEHOF, AROSA" P. WIELAND.

BÂLE. "HOTEL, VICTORIA."

(Quite near Central Railway Station.)

First-class Family House of old reputation. Lately quite renewed. Fine Large Hall, New Salon, and Conversation Rooms. Restaurant. Electric light and central heating in whole house.

NEW BATHS. LIFT. GOOD CUISINE. MODERATE CHARGES.

Managed by the Proprietor—PAUL OTTO.

BROWN & ROWLEY

WATLING STREET, CITY,

Printers,

Account Book Manufacturers,

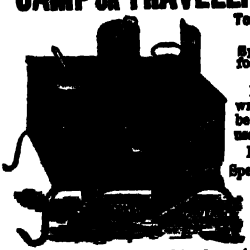
AND

General Stationers.

Contractors to the Royal Geographical Society.

THE WROUGHT IRON

CAMP OR TRAVELLING STOVE



To burn wood or any fuel.

Specially designed for Explorers, Missionaries, etc

Made of malleable wrought iron. Cannot be injured by rough usage. Weight 36 lbs.

Price complete, £3.

Specialities in Oil Cooking Stoves for Home and Export. Any kind of stove made to order.

Send for a 100-page Illustrated Catalogue of Stoves for all purposes, which will be sent free by mail on application.

W. POTTER & CO., American Stove Stores.



In addition to Visible Writing, the

OLIVER TYPEWRITER

Has a unique, double, down-striking Type-bar of enormous strength that makes it easily the most powerful Manifolder, and the best Typewriter for writing stencils for the Copying Machine or Duplicator. It is a matured machine, strong and durable, powerful and popular, efficient, resourceful, adaptable.

We have a Special Message for

ALL USERS OF TYPEWRITERS.

Send for "SPECIAL PROPOSAL," No. 28, mentioning this *Journal*.

OLIVER TYPEWRITER CO., LTD.,
75, QUEEN VICTORIA STREET,
LONDON, E.C.

By Royal Warrant  to H.M. THE KING.

When appetite is dull and you feel the need of something to make your meals enjoyable, just try the effect of a lit.

LEA & PERRINS' SAUCE.

It is a wonderful appetizer, and assists digestion.

Excellent with MEAT DISHES, FISH, SOUP, GAME, CHEESE, SALADS, &c.

For List of Council and Officers, Conditions of Admission to the Fellowship of the Society, and Society Notices, see pages ii., iv., vi., and viii.

The Geographical Journal.

Authors are alone responsible for their respective statements. In MS. communications all new or unfamiliar geographical names should be written in imitation of Roman type. All communications for the Editor should be addressed to 1, Savile Row, London, W.

CONTENTS—MARCH.

PAGE

A Journey in North-Western Arabia. By Douglas Carruthers (with 7 Plates and Map) . 225
Notes on Kordofan Province. By Captain Watkins Lloyd, The Cameronians (Scottish Rifles), late Governor of Kordofan (with 8 Illustrations and Map) 249
The Cycle of Mountain Glaciation. By Prof. William Herbert Hobbs, University of Michigan (with 5 Plates and 10 Diagrams) 268
A Tour in the Liberian Hinterland. By Captain Braithwaite Wallis, F.G.S., F.R.G.S., His Majesty's Consul-General at Dakar, lately H.M.'s Consul-General for Liberia (with Map) 285
Project of a Danish Expedition to the Central Eskimo. By Knud Rasmussen . . 295
Notes on Determination of Position near the Poles. By Arthur R. Hinks, Royal Geographical Society Lecturer in Surveying and Cartography, Cambridge University (with Diagram) 299
The Forests of British East Africa. By M. H. 313
The Annual Meeting of the Geographical Association. Address by the President, Douglas W. Freshfield 314
Geography at Oxford 316
The Capital of the Australian Commonwealth (with 3 Sketch-maps) 318
Reviews :—
EUROPE—Iceland. ASIA—Tibet. A Japanese Pilgrim in Tibet. AFRICA—The Partition of Africa. South African History. AMERICA—Panama and Ecuador. Explorations in Southern Brazil. 321
Expedition of H.R.H. the Duke of the Abruzzi to the Karakoram 330
The Monthly Record 332

EUROPE
The Fichtelgebirge in Literature
ASIA
An Expedition to North-West Mongolia
AFRICA
The Railway System of the Anglo-Egyptian Sudan
French Equatorial Africa
Irrigation in South Africa
Railway Construction in South-Central Africa
AMERICA
The Pine Trees of Arizona in Relation to Weather Cycles
Expeditions in South America
AUSTRALASIA AND PACIFIC ISLANDS
Surveys in New Zealand
Exploration in New Guinea
POLAR REGIONS
Dr. Charcot's Antarctic Expedition
United States South Polar Expedition
Other Proposed Expeditions to the Antarctic Regions
MATHEMATICAL AND PHYSICAL GEOGRAPHY
A New Cartographical Instrument
Glacial Erosion
GENERAL
The Oceanographical Museum at Monaco

Meetings of the Royal Geographical Society, Session 1909-1910 339
Geographical Literature of the Month 340
New Maps 350

MAPS.

Sketch-map of North-West Arabia 356
Map of the Sudan Province of Kordofan 356
Prismatic Compass Traverse in Liberia 356

SOLD BY

PARIS: Barrère.
VIENNA: Artaria & Co.
HAMBURG: L. Friederichsen & Co.
MANCHESTER: John Heywood.
EDINBURGH: Douglas & Foulis.
DUBLIN: Hodges, Figgis & Co.
BERLIN: D. Reimer.
LEIPZIG: F. A. Brockhaus.

ROYAL GEOGRAPHICAL SOCIETY.

PATRON.

HIS MAJESTY THE KING.

VICE-PATRON.

HIS ROYAL HIGHNESS THE PRINCE OF WALES, K.G.

COUNCIL.

(ELECTED MAY 24, 1909.)

President—Major Leonard Darwin.

Vice-Presidents.

Admiral Sir Lewis Beaumont, K.C.B., K.C.M.G.
Rt. Hon. Lord Curzon of Kedleston, G.C.S.I., G.C.I.E., etc.
Douglas W. Freshfield.
Rt. Hon. Sir J. West Ridgeway, K.C.B., G.C. K.C.S.I.
H. Yates Thompson, J.P.
Sir Clements R. Markham, K.C.B., F.R.S., F

Treasurer—Edward L. Somers Cocks.

Trustees—Right Hon. Lord Avebury, D.C.L., F.R.S.; Lord Belhaven and Stenton.

Honorary Secretaries—Colonel Chas. F. Close, C.M.G., R.E.; Colonel Sir D. A. John K.C.M.G., C.B., R.E.

Foreign Secretary—Sir John Kirk, K.C.B., G.C.M.G., F.R.S.

Members of Council.

Henry Balfour, M.A., F.Z.S.
Captain H. H. P. Deasy.
Admiral A. Moreton Field, F.R.S.
Colonel H. W. Feilden, C.B.
Sir William Edmund Garstin, G.C.M.G.
Sir David Gill, K.C.B., LL.D., F.R.S.
Rt. Hon. Sir George D. Taubman Goldie, K.C.M.G., F.R.S., D.C.L., LL.D.
Colonel R. C. Hellard, C.B., R.E.
Sir Clement L. Hill, K.C.M.G., K.C.B., M.P.
Colonel Sir Thomas Hungerford Holdich, K.C.M.G., K.C.I.E., C.B., R.E.
James F. Hughes.
Rt. Hon. Lord Lamington, G.C.M.G.
Sir George S. Mackenzie, K.C.M.G., C.B.
Halford John Mackinder, M.A.
Alfred P. Maudslay.
Colonel F. R. Maunsell, C.M.G., R.A.
Earl of Ronaldshay, M.P.
Captain R. F. Scott, C.V.O., R.N.
Colonel Sir Colin C. Scott-Moncrieff, K.C.I K.C.S.I., R.E.
Dr. Aubrey Strahan, F.R.S.
Sir Edward P. Tennant, Bart., M.P.

Secretary and Editor of Publications—J. Scott Keltie, LL.D.
Librarian—Edward Heawood, M.A.

Map Curator.	Chief Clerk.
Edward A. Reeves, F.R.A.S.	S. J. Evis.

Bankers—Messrs. Cocks, Biddulph and Co., 43, Charing Cross.

Candidates for admission into the Society must be proposed and seconded by Fello and it is necessary that the description and residence of such Candidates should be clea stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and £3 as an "subscription for the current year, and thereafter a yearly subscription of £3, due on the 1st Janu "of each year; or he may compound either at entrance by one payment of £45, or at any subsequ "period on the following scale, provided that there shall be at the time no arrears due by him "the Society:—

Fellows of 10 years' standing and under	15			...	£30
"	15	"	20	...	£24
"	20	"	and over	...	£18 15s.

"No fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear."

All Subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow include admission (with one Friend) to all ordina Meetings of the Society, and the use of the Library and Map-room. Each Fellow is a entitled to receive a copy of all the Society's Periodical Publications.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had application at the Society's Office, 1, Savile Row, London, W.

Waterman's Ideal Fountain Pen



The World's best Fountain Pen, and the one you will eventually buy

Mr. Sydney Whitman writes: "Although I have received at different times various kinds of Fountain Pens as presents, I have nevertheless been obliged to invest in a Waterman's Ideal, and now use it exclusively."

Mr. Bennett Burleigh, the famous War Correspondent, writes: "It is the only Fountain Pen that does not dry up or blubber in the desert."

PRICES—10/6, 15/-, 17/6, 21/-, 25/-, 35/-, and upwards. In Silver and Gold for Presentation. Of Stationers, Jewellers, &c. Booklet, post-free, from L. & C. HARDTMUTH, 12, Golden Lane, London, E.C.

New York, 173 Broadway; Paris, 6 Rue de Hanovre, Vienna, 1 Franzensring 20, Milan, Via Bossi 4, Dresden, Prageratrasse 6, Brussels, 14; Rue du Pont Neuf (Ask your Stationer to show you Waterman's Ideal Pump-Filling and Safety Pens—at 12s 6d and upwards.)

PERMANENTLY ENLARGED TO [illegible]
MONTHLY 1/- NET.

TRAVEL AND EXPLORATION.

(Edited by EUSTACE REYNOLDS-BALL.)

MARCH, 1910.

Recollections of the Siamese-Malay Peninsula. EDMUND FORBES.

On Mount Sinai. "ATHENA."

Hints on Outfit for Arctic Regions. HARRY DE WINDT.

Lines in Many Waters. "SABCELLE," of the *Field*.

A New Norwegian Ski-ing Centre. ARNOLD H. M. LUNN.

"The Gates of India." "ZAKPHO."

Travel Photography. F. R. BALL.

Expansion of the Riviera. A. S. BROWNE.

Outfit and Equipment for the Traveller, Explorer, and Sportsman. Part III.

Among the Articles arranged for the April number (published March 26th), are—

Sarawak, by HARRY DE WINDT. The Hill Regions of Assam, by T. C. HODSON. Maps and Map-making, by "PEDOMETER." Hints for Big Game Shooters, by F. C. SELOUS. Polo on the Riviera, by Captain D. E. MILLER, D.S.O. Khartoum: a Renascent Capital.

WITHERBY & Co., 326, HIGH HOLBORN, W.C.

THE THAMES

NAUTICAL TRAINING COLLEGE.

H.M.S. "WORCESTER."

Established, 1862. Incorporated, 1893.

Chairman:
Sir THOS SUTHERLAND, G.C.M.G., LL.D.
Vice-Chairman:
Admiral the Hon. Sir EDMUND FREMANTLE, G.C.B., C.M.G.
Capt.-Superintendent:
Commander D. WILSON-BARKER, R.N.R., F.R.S.E., F.R.G.S.
Head Master:
F. S. ORME, M.A. (Emm. Coll., Camb.)

The Ship is anchored in the Thames off Greenhithe, in one of the most healthy reaches of the river. The College is devoted more particularly to the education of youths intending to become OFFICERS in the MERCANTILE MARINE, and over 3000 Cadets have already passed out as duly qualified in that capacity. At the same time an excellent system of GENERAL EDUCATION is carried out. Moderate terms.

For illustrated prospectus, apply to the Secretary, 72, Mark Lane, London, E.C.

POTTER'S

Catalogue (84 pp.) of

Books on Travel and Sport

(chiefly new copies at greatly reduced prices)

SENT POST-FREE.

WILLIAM POTTER,

30, Exchange Street East, Liverpool.

DELICIOUS COFFEE.

RED WHITE & BLUE

For Breakfast & after Dinner.

ROYAL GEOGRAPHICAL SOCIETY.

NOTICES.*

Ordinary Meetings during March and April.—Monday, March 7. Land a People in the Kassai Basin. By E. Torday.—Monday, March 14. Boundar making on the Bolivio-Brazilian Frontier. By Major P. H. Fawcett, R.A. Monday, April 11. Across Africa from the Niger to the Nile. By Dr. Ka Kumm.—Monday, April 18. Exploring and Climbing in the Karakoram. By I T. G. Longstaff.

Year-book for 1909.—The Year-book for 1909 is now ready, and can l obtained on application to the Chief Clerk, 1, Savile Row, W. Price, to Fellow 1*s.*; to non-Fellows, 2*s.* 6*d.*

Fellows' Reading-room.—The front room on the first floor of the Society's hou is arranged as a Reading-room for Fellows. On a few days of the year it will l required for Meetings of the Council, on which occasions a notice will be fixe outside the door of the room.

Any Fellow desiring to have notice of the subjects of papers to be read at th Society's Meetings forwarded to him, can receive such notices by post on paymen in advance to the Chief Clerk, at 1, Savile Row, of 2*s.* per session.

* See also pp. vi., viii., and x.

WRIGHT'S
COAL TAR SOAP

is acknowledged as an

ABSOLUTE SPECIFIC

in warding off the bites of

Mosquitos and Other Insects.

"VERB. SAP. ON GOING TO WEST AFRICA," says: "Wright's Coal Tar Soap is good for Prickly Heat and refreshing to the skin."

For Travellers it is packed in an Enamelled Tin Box, containing one Tablet, price 5d.

If any difficulty in obtaining, please write to
The Proprietors of WRIGHT'S COAL TAR SOAP,
48, Southwark Street, London, S.E.



"BERKEFELD" FILTER



YIELDS

Absolutely Pure and Germ Free Water.

IN USE ALL OVER THE WORLD.

General Sir James Willcocks, D.S.O., in the *Empire Review*, says: –

"One word more regarding Camp Equipment and I have done. Whatever may or may not be taken, it is absolutely necessary to have a couple of portable filters, and the 'Berkefeld' is the best."

THE BERKEFELD FILTER CO., LTD.,

121, OXFORD STREET, LONDON, W.

ORIENT CRUISES TO SUNNY LANDS.

PORTUGAL
SPAIN
MOROCCO
ALGERIA
GREECE
ASIA MINOR
TURKEY
EGYPT
MALTA

By the

S.S. "ORMUZ," 6465 tons register.

FROM MARSEILLES—

12th March to 8th April.
9th April to 22nd April.

Fares from 13 to 55 Guineas.

Managers { F. GREEN & CO. / ANDERSON, ANDERSON & CO. } Head Office: Fenchurch Avenue, London, E.C.

For Passage apply to the latter firm, at 5, Fenchurch Avenue, London, E.C.; or to the West End Branch Office, 28, Cockspur Street, S.W.

MARTIN BEHAIM: HIS LIFE AND HIS GLOBE.

By E. G. RAVENSTEIN, F.R.G.S.

An exhaustive Memoir with numerous Illustrations and Coloured Maps, and a Facsimile of Behaim's Famous Globe, printed in 15 Colours on 4 Sheets, 24 by 30 inches.

Large 4to, antique cover, gilt top, enclosed in cardboard case.

PRICE £3 3s. NET.

THE EDITION IS STRICTLY LIMITED TO 515 NUMBERED COPIES.

PHILIPS' IMPERIAL ATLAS OF THE WORLD.

154 Maps printed on 80 large Coloured Plates, size 22 in. by 28 in. Each map separately Indexed, forming a total of over 200,000 Names, with Latitude and Longitude.

Length, 22½ in.; Width, 16 in.; Thickness, 2½ in.; Weight, 25 lbs.

PRICE:—Half Leather, Gilt Edges, £8:0:0; Full Leather, £10:10:0.

GEORGE PHILIP & SON, Ltd., 32, Fleet Street, London, E.C.



PORTABLE

ACETYLENE LIGHTS.

Easy to carry. Easy to handle. Easy to understand.

No attention required after lighting.

FOR TRAVELLERS. PROSPECTORS. PIONEERS.

For all Countries and all Climates.

FLARE-LIGHTS each 500 to 5000 c.p. HAND-FLARES 250 to 1000 c.p.

Not affected by Weather. Will stand a Gale.

HAND-LAMPS 100 c.p. HAND-LANTERNS 20 c.p.

PORTABLE GENERATORS complete in one casing for 2 to 20 lights.

Full particulars from the Patentees and Sole Makers—

NOTICE.

PHOTOGRAPHS.

ROYAL GEOGRAPHICAL SOCIETY.

It would greatly add to the value of the Collection of Photographs whi has been established in the Map Room of the Royal Geographical Society, all the Fellows who have taken photographs during their travels, woul forward copies of them to the Map Curator, by whom they would be acknov ledged. Should the donor have purchased the photographs, it will be usef for reference if the name of the photographer and his address are given.

Established nearly a Century.

HILL & SON,

4, HAYMARKET, LONDON,

Manufacturers of

Sporting, Table, Toilet & Pocket Cutlery.

ALPINE ICE-AXES; SKATES,

AND FINE STEEL WORK GENERALLY.

Practical Dodgy Utilities for Home Requirements and Travellers' Use.

☞ Reliable English-made Goods at Moderate Prices.

CHOLERA WAS AVOIDE

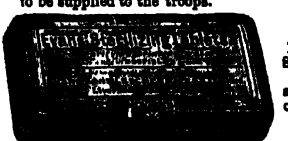
by the BRITISH TROOPS in the recent

MOHMAND CAMPAIGN

by the use of

Evans' Sterilizing Tablet

specially ordered by the Indian Government to be supplied to the troops.



In three sizes, 1s., 1s 6d. 3s.

Fre Sam on appl applic

Bacteriological reports, and full particulars from proprietors, 60, BARTHOLOMEW CLOSE, LONDON.

The Zanetic Pat. Copying Book

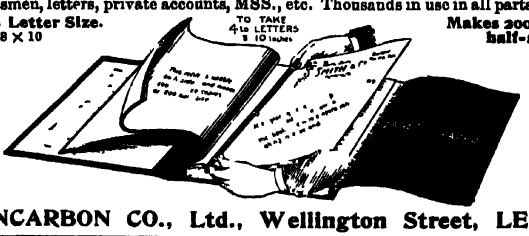
To copy letters while writing, you simply place your writing paper in the Zanetic copying book and write as usual. The Act of Writing produces the copy. Extremely useful for keeping copies of orders to tradesmen, letters, private accounts, MSS., etc. Thousands in use in all parts of the world.

Order as No. 20/100 Letter Size.
To take letters 8 × 10

4/9 complete

Weight 1lb. 14oz
Refills 1/6 each
Weight 12oz

The simplest, yet the most efficient and economical of all copying systems.



Makes 200 full size or 400 half-size copies.

If 200 leaves 5/6, fills 2/3 each. N size: 100 leaves 3 refills 1/3 each; o 200 leaves 3/9, refi 1/6 each.

Samples of Zaneti copying paper fre from—

THE PENCARBON CO., Ltd., Wellington Street, LEICESTER.

An Echo from the South Pole.

Feb. 7, 1910.

Messrs. NEWMAN & GUARDIA, LTD.,
17 & 18, Rathbone Place, Oxford St., W.

"DEAR SIRS,—I have much pleasure in saying that all the photographic equipment gave us complete satisfaction. The camera used on the Southern journey was a Newman and Guardia, and the excellent photographs which we have been able to bring back are the best testimonial that you could positively have.

"Yours faithfully,
"British Antarctic Expedition,
"E. H. SHACKLETON, Commander."

Extract from letter received

NATURAL HISTORY

WATKINS & DONCASTER

NATURALISTS

36, STRAND, LONDON, W.C.

(Five Doors from Charing Cross)

keep in stock every description of Apparatus, Cabinets, Books, and Specimens for Collectors o

BIRDS' EGGS, BUTTERFLIES AND MOTHS, &c.

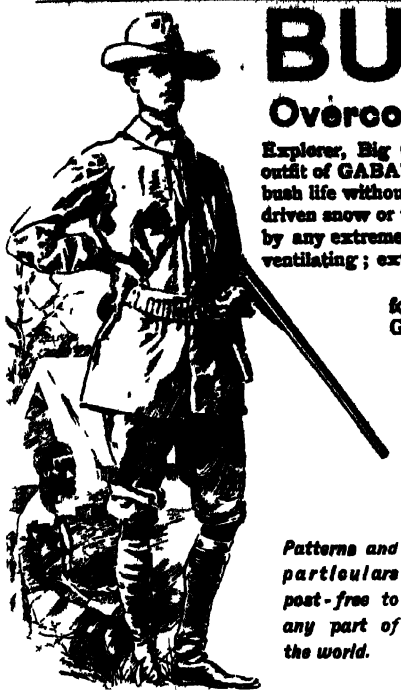
Price List sent post-free on application.

BURBERRY

Overcoats, Suits and Tents.

Explorer, Big Game Hunter, Mountaineer or Colonial with an outfit of GABARDINE has that which will stand the rigours of bush life without showing signs of wear, and keep out blizzard-driven snow or tropical downpours. The proofing is not affected by any extreme of climate; it is wind-proof yet faultlessly self-ventilating; extremely light, yet so strong as to be untearable.

Such union in numbers of the great essentials for comfort in camp life is to be found in GABARDINE AND GABARDINE ONLY.



GABARDINE SUIT.

Patterns and particulars post-free to any part of the world.



GABARDINE TENTS.
Extremely light, imperishable, and non-absorbent.

BURBERRYS, 30 to 33, Haymarket, LONDON.

The Best Value on Earth.

Goodyear-Welted BOOTS & SHOES.

Randall's noted "Tenacious" Brand are Goodyear-Welted.

NOTICE.

INSTRUCTION FOR INTENDING TRAVELLERS.

Under the authority of the Council of the R.G.S.

Arrangements have been made for the instruction of intending travellers in the following subjects:—

Surveying and Mapping, including the fixing of positions by Astronomical Observations. By Mr. E. A. Reeves, F.R.A.S., Map Curator of the Society.

Geology, including practical training in the field. Under the superintendence of the Director-General of the Geological Survey.

Botany. Under the superintendence of the Director, Royal Gardens, Kew.

Zoology. By Dr. R. Bowdler Sharpe, Natural History Museum, South Kensington.

Anthropological Measurements. Under the superintendence of Dr. J. G. Garson, Anthropological Institute.

Photography. By Mr. John Thomson, Author of 'Photographic Illustrations of China and its People,' and other works.

Meteorology. By Dr. H. R. Mill.

Outfit and Health. Dr. Charles F. Harford, Secretary of the Travellers' Health Bureau.

The Lessons are given on days and at hours arranged between the Instructor and the pupil. Tickets for the lessons, at 2s. 6d. for each hour's lesson, must be previously procured at the Offices of the Society.

Silvertown

India Rubber, Ebonite, & Gutta Percha Goods

of all Descriptions.

WATERPROOF GARMENTS and FABRICS.

The India Rubber, Gutta Percha & Telegraph Works Co.,

Limited.

Head Offices - - 106, CANNON STREET, LONDON, E.C.

Works - - - - SILVERTOWN, LONDON, E.

BRANCHES:

HOME: Belfast, Birmingham, Bradford, Bristol, Cardiff, Dublin, Glasgow, Liverpool, Manchester, Newcastle, Portsmouth, Sheffield.

ABROAD: Adelaide, Brisbane, Buenos Ayres, Bulawayo, Calcutta, Christchurch (N.Z.), Durban, Johannesburg, Melbourne, Perth (W.A.), Sydney.

CLARKSON'S

SECOND-HAND OPTICAL MART,

398, HIGH HOLBORN, W.C.

(*Opposite Gray's Inn Road*).

Sextants, Theodolites, Surveyors' Instruments, Prism Binoculars, Telescopes, and other Second-hand Optical Instruments by the best makers.

Telephone: 2149, Holborn.

All communications respecting Advertisements in the

"GEOGRAPHICAL JOURNAL"

to be sent to

G. STREET & CO., LTD.,

Use Odourless or Germicidal

FLORIGENE

(A Registered Name suggested by Floor-Hygiene)

On all School, Laboratory, Library, Museum, Studio, Office, and other Floors—either Wood, Linoleum, Stone, Concrete, or Polished, &c.

—for the anhydrous

LAYING of DUST.

Each application lasts for two to six months, according to wear. The ordinary daily sweeping alone required to clean the floors—no scrubbing (*useless preferred*) or sprinkling of any kind—therefore no injurious moisture.

The "DUST-ALLAYER" Co.,

65, Queen Victoria Street, London, E.C.

Contractors to Admiralty, War Office, H.M. Office of Works, &c.

COOK'S TOURS.

INDEPENDENT TICKETS available at any time on nearly every Railway, Steamship and Coach throughout the World.

Pleasure Cruises. Select Cruises by first-class Steamers.

Ocean Travel. Passages at Lowest Rates to United States, Canada, South Africa, Egypt, India, China, Japan, Australasia, etc.

Select Conducted Parties. Leave chief European Cities at frequent intervals throughout the Season.

Popular Holiday Tours. Conducted Weekly Parties to Lucerne, etc.

Inclusive Independent Travel. The acme of travel without trouble is attained by the above method. By it the traveller journeys with absolute independence, but with every detail arranged beforehand, and practically every expenditure provided for. Write for explanatory prospectus.

Banking and Exchange. Foreign moneys exchanged. Letters of Credit and Circular Notes issued.

Baggage and Goods. Collected, stored and forwarded.

FREE ASSISTANCE OF COOK'S INTERPRETERS at the principal Stations and Seaports.

Hotel Coupons. Hotel Coupons are issued from 7*s.* 6*d.* to 16*s.* per day, available at one or more of the principal hotels in each of the chief cities, towns, and places of Tourist resort in Great Britain, and on the Continent. Full particulars are given in the *Traveller's Gazette*, 8*d.* monthly; by post, 6*d.*

THOS. COOK & SON,

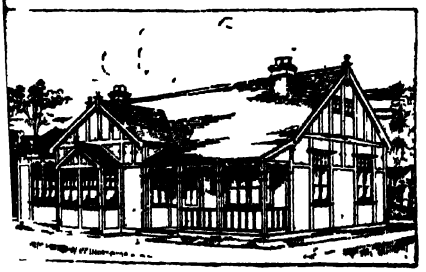
CHIEF OFFICE:

Ludgate Circus, LONDON.

BRANCHES THROUGHOUT THE WORLD.

W. HARBROW, IRON BUILDING WORKS, S. Bermondsey Station, S.E.

TELEGRAMS—"ECONOMICAL, LONDON." TELEPHONE—HOP. 17.



DESIGN No. 287.

BUNGALOW, specially designed for Tropical Climates. Excellently well ventilated. Large Living Room, Four Bedrooms, Pantry, and Store.

PRICE: Delivered F.O.B. London, prepared for re-erection, including all key plans, **£189.**

Vermin-proof foundation columns and steps provided at an extra cost of £21.

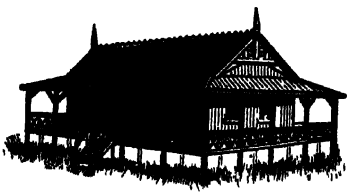
DESIGN 139a.

BUNGALOW, containing Drawing-room, Dining-room, Three Bedrooms and usual Offices.

Constructed of timber framework, roofing red diagonal asbestos tiles, walls "Rough Cast" plastering.

PRICE £280,

including foundations, chimneys, and fittings.



100 page Catalogue of Churches, Chapels, Mission Halls, Bungalows, Cottages, Billiard Rooms, Stores, Iron Ranges, Club Rooms, Farm Buildings, Sheds, Gymnasiums, Aeroplane and Motor Garages, &c., **Post Free** on mentioning this publication.

Special **Export Catalogue.** Manufacturer of every description of Church Furniture, Building Ch...

ROYAL GEOGRAPHICAL SOCIETY.

THE SOCIETY'S PUBLICATIONS.

THE GEOGRAPHICAL JOURNAL. Issued Monthly. Delivered free to all Fellows; price to l Fellows, 2s.

GENERAL INDEX TO THE FIRST 20 VOLUMES OF THE GEOGRAPHICAL JOURN 1893–1902. 660 pages, double columns. Price, to Fellows, 2s. 6d. net; to Non-Fellows, 10s. 6d.

JOURNAL OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1830–1880. volumes, 8vo. Price, to Non-Fellows, £1 per vol. net; to Fellows, 18s. per vol.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1855–1 23 volumes, 8vo. In parts, to Non-Fellows, 1s.; to Fellows, 9d. per part.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (NEW SERIES), consist 14 volumes, extending from 1879 to 1892.

Each volume covers on an average 840 pages, the selling price being 18s. per volume. These volumes constitute a r of exploration and geographical work in all parts of the world. In the 14 volumes there are some 350 maps, b numerous illustrations of characteristic scenery in the least-known parts of the world. It is believed that a com set of the *Proceedings* would be a valuable addition to public libraries and other institutions, while many pr individuals might wish to have the volumes. The series is now offered, bound in cloth, at £6 per set.

SUPPLEMENTARY PAPERS.

Containing a large number of Memoirs and Narratives of considerable length, besides several valuable Bibliograp over 30 Maps and numerous Illustrations. Sold for half price, £2 for the four volumes.

HINTS TO TRAVELLERS.—The ninth revised edition, edited, under a Committee of the Cou by E. Reeves, F.R.A.S., Map Curator and Instructor to the Society. Price 15s. net; to Fellows, at the House o Society, 10s.

TRIGONOMETRY—PLANE AND SPHERICAL. Specially arranged for the use of Students att ing the Royal Geographical Society's course of Instruction. By E. A. Reeves, F.R.A.S. Price 5s. net.

HINTS ON OUTFIT FOR TRAVELLERS IN TROPICAL COUNTRIES. By Charles Fo Harford, M.A., M.D. Price 1s. 3d. net.

CATALOGUE OF THE LIBRARY OF THE R.G.S. Edited by Dr. H. R. Mill. Price Fellows, 2s. 6d. net; to Non-Fellows, 5s.

THE YEAR-BOOK OF THE SOCIETY. Issued annually. Price, to Non-Fellows, 2s. 6d.; Fellows

SYLLABUSES OF INSTRUCTION IN GEOGRAPHY. I. In Elementary Schools. II. In Secon Schools. Single copies gratis on application at 1, Savile Row, W.

EXTRA PUBLICATIONS.

THE FIFTY YEARS' WORK OF THE ROYAL GEOGRAPHICAL SOCIETY. By Clements R. Markham, K.C.B., F.R.S., President. 288 pp. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. ne

THE LANDS OF CAZEMBE. LACERDA'S JOURNEY TO CAZEMBE IN 1798. Transl and annotated by Captain R. F. Burton. 271 pp., with Map. Also Journey of the Pombeiros, P. J. Baptista, Amaro José, across Africa from Angola to Tette on the Zambese. Translated by B. A. Beadle. And a *Résumé* o Journey of MM. Monteiro and Gamitto. By Dr. C. T. Beke. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. n

THE TOPOGRAPHY OF THE BATTLE OF PLATÆA. By G. B. Grundy, B.A. Price, b in half-calf, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

NOTES ON THE KURIL ISLANDS. By Captain H. J. Snow. 8vo, 88 pp., with two large Ch revised by Captain Snow. Price, in boards, to Non-Fellows, 4s. net; to Fellows, 2s. net.

EASTERN PERSIAN IRAK. By General A. Houtum-Schindler. 8vo, 132 pp., with Map. P to Non-Fellows, 5s. net; to Fellows, 3s. net.

A JOURNEY ON THE UPPER MEKONG, SIAM. By H. Warington Smyth. Sixty Illustrat and three Maps. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 4s. net.

BIBLIOGRAPHY OF ALGERIA, FROM THE EXPEDITION OF CHARLES V. IN 1511 1887. By Sir R. L. Playfair. Price, to Non-Fellows, 7s. 6d.; Fellows, 5s. net.

EDUCATIONAL REPORTS. By Dr. J. Scott Keltie. Price, to Non-Fellows, 5s.; to Fellows, 2s

SUPPLEMENT TO THE BIBLIOGRAPHY OF ALGERIA, FROM THE EARLIEST TI TO 1895. By Sir Lambert Playfair, K.C.M.G. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

MAP OF THE KARAKORAM HIMALAYAS. In two sheets, with text. By Sir W. Ma Conway, M.A. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

SURVEYING AND EXPLORING IN SIAM. By James McCarthy. Large Maps of Siam many Illustrations. 236 pp. 8vo. Price, to Non-Fellows, 10s. 6d. net; to Fellows, 6s. 6d. net.

THE DISTRIBUTION OF RAINFALL OVER THE LAND. By Dr. A. J. Herbertson. I to Non Fellows, 5s. net; to Fellows, 2s. 6d. net.

ON THE RESULTS OF A DEEP-SEA SOUNDING EXPEDITION IN THE NOI ATLANTIC DURING THE SUMMER OF 1899. By R. S. Peake, M.Inst.C.E. With Notes on Temperature, Sea Deposits, &c. By Sir John Murray, K.C.B., F.R.S. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

ARCTIC PAPERS FOR THE EXPEDITION OF 1875. A selection of Papers on Arctic graphy and Ethnology. Reprinted and presented to the Arctic Expedition of 1875, by the President, Council Fellows of the Royal Geographical Society. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 5s. net.

THE ANTARCTIC MANUAL, FOR THE USE OF THE EXPEDITION OF 1901. E by George Murray, F.R.S. 602 pp. royal 8vo. Price, to Non-Fellows, 15s. net; to Fellows, 10s. net.

JOURNEY TO LHASA AND CENTRAL TIBET. By Sarat Chandra Das, C.I.E. Editec the Hon. W. W. Rockhill. Maps and Illustrations. 285 pp. 8vo. Price, bound in cloth, to Non-Fellows, 10s net; to Fellows, 7s. net.

NEW MAP OF THE RIVER CONGO, in Ten Sections on Five Sheets. Scale 1 : 500,00 miles = 1 Inch). By the Rev. George Grenfell. In small portfolio, with Memorandum. Price, to Non-Fel 10s. net; to Fellows, 6s. net.

ON RECENT CONTRIBUTIONS TO OUR KNOWLEDGE OF THE FLOOR OF THE NOR ATLANTIC OCEAN. By Sir John Murray, K.C.B., F.R.S., and R. E. Peake, M.Inst.C.E. Price, to Non-Fellow net; to Fellows, 2s. 6d. net.

AN EXPEDITION INTO THE CENTRAL TIAN-SHAN MOUNTAINS. By Dr. Gottfr Merzbacher. Price, to Non-Fellows, 12s. net; to Fellows, 9s. net.

MAP OF TIBET. New edition, 1906. Price, to Fellows, 3s. net; to Non-Fellows, 5s. net.

GEOGRAPHICAL DISTRIBUTION OF VEGETATION IN SOMERSET. By Dr. C. E. M Price, to Fellows, 2s. 6d. net; to Non-Fellows, 5s. net.

BIBLIOGRAPHY OF TOPOGRAPHICAL AND GEOLOGICAL WORKS ON THE PHLEGRA FIELDS. By R. T. Günther. Price, to Fellows, paper covers, 2s. 6d., boards, 3s. net; to Non-Fellows, paper co 5s., stiff boards, 6s. net.

NATIONAL ANTARCTIC EXPEDITION, 1901–4. Charts of the Expedition, with Memoir by L G. F. A. Mulock, R.N. Price, to Non-Fellows, 12s. 6d. net; to Fellows, 9s. net.

MOUNTAIN PANORAMAS FROM THE PAMIRS AND KWEN LUN. With Introduction Descriptions by Dr. M. Aurel Stein. Price, to Non-Fellows, £1 net; to Fellows, 14s. net.

BATHYMETRICAL SURVEY OF THE FRESHWATER LOCHS OF SCOTLAND. U

JUST PUBLISHED.

ZAMBEZIA.

A General Description of the Valley of the Zambesi River, from its Delta to the River Aroangwa, with its History, Agriculture, Flora, Fauna, and Ethnography. By R. C. F. MAUGHAM, H.B.M. Consul to Portuguese East Africa. Author of "Portuguese East Africa." With Map and Illustrations, demy 8vo, 15s. net.

IN THE TORRID SUDAN.

By H. LINCOLN TANGYE, F.R.G.S.

With Illustrations. 12s. net.

This book, while dealing with sport and travel in the Sudan, also describes its geography and interesting history, its internal conditions, administration, and development. Incidents of an extended shooting trip are related, and a particular feature is the description of a journey into a little-known part of the country where the human being is exhibited in his primitive state.

JOHN MURRAY, ALBEMARLE STREET, W.

J. & J. LEIGHTON, BOOKSELLERS AND BOOKBINDERS,

ESTABLISHED 1798. **40, BREWER STREET,** Golden Square, Regent Street, London, W.

Illuminated MSS., Incunabula and other Early Books with Woodcuts, Bookbindings of Historical and Artistic Interest, etc., etc.

ILLUSTRATED CATALOGUE, 7,500 items, with upwards of 2,060 facsimile reproductions in line and half-tone, with full descriptions and bibliographical information

SPECIMEN PART WITH PROSPECTUS, POST FREE ON APPLICATION.

ROYAL GEOGRAPHICAL SOCIETY.

EXTRA PUBLICATION.

Mountain Panoramas from the Pamirs and Kwen Lun,

WITH INTRODUCTION AND DESCRIPTIONS

By Dr. M. AUREL STEIN.

IN BLUE CLOTH CASE, GILT.

Price, to Fellows of the Society, 14s. net; to non-Fellows, 20s. net.

LONDON:

ROYAL GEOGRAPHICAL SOCIETY, 1, SAVILE ROW, W.

EDWARD STANFORD, 14, Long Acre, W.C.

CLOTHING WEAR

When buying a Ventilated Garment, do not simply ask for Cellular, but ask for

AERTEX Cellular

LOOK FOR THIS OVAL LABEL

THE CELLULAR CLOTHING Co. LTD. AERTEX LONDON

LOOK FOR THIS OVAL LABEL

so as to make certain you get the genuine and original make.

BEWARE OF IMITATIONS SOLD UNDER SIMILAR NAMES.

AERTEX Cellular Garments are made from a cloth composed of small cells, in which the air is enclosed. The body is thus protected from the effects of outer heat or cold, while the action of the pores of the skin is not impeded.

ILLUSTRATED PRICE LIST of full range of AERTEX CELLULAR goods for Men, Women, and Children, with list of 1 500 Depots where these goods may be obtained, sent Post Free on application to THE CELLULAR CLOTHING Co., Ltd., Fore Street, London, E.C.

ROBERT SCOTT, Ltd., 8, Poultry, Cheapside, E.C.
OLIVER BROS., Ltd., 417, Oxford Street, W.

USED BY DOCTORS and the PUBLIC for OVER HALF-A-CENTURY.

Dr. J. Collis Browne's Chlorodyne

The ORIGINAL and

The Best Remedy Known for

COUGHS, COLDS, ASTHMA, and BRONCHITIS.

Acts like a Charm in

DIARRHŒA, CHOLERA, and DYSENTERY.



ONLY GENUINE.

Admitted by the Profession to be the **MOST VALUABLE REMEDY** ever discovered.

Effectually cuts short all attacks of **SPASMS.**

The only Palliative in **NEURALGIA, TOOTHACHE, GOUT, RHEUMATISM.**

Convincing Medical Testimony accompanies each bottle.

SOLD IN BOTTLES BY ALL CHEMISTS,
at 1/1½, 2/9, and 4/6 each.

INDEX TO ADVERTISEMENTS.

Where no number is given, the Advertisement does not appear this month.

PAGE

Account Book Makers.
Brown & Rowley 18

Bookbinders, Booksellers, &c.
Leighton, J. & J. 11
Sotheran & Co. ..... *Cover* 2

Boots and Shoes.
Dowie & Marshall 13
Goodyear-Welted 7

Colleges.
Thames Nautical Training 3

Cutlery.
Hill & Son 6

Electrical Engineers.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd. ... 8

Electric Lighting.
Tredegar & Co. .....
Wakefield & Co. 8

Filters.
Berkefeld 5
Doulton & Co., Ltd. 13

Goods for Travellers.
Bovril ..... *Cover* 2
Oxo 14
Plasmon .....
Red, White & Blue Coffee 3

Fountain Pens.
Waterman's Ideal Fountain Pen 3

Furniture and Floor Polish.
Ronuk, Limited 16

Hotels and Restaurants.
Hôtel Métropole 15
Hotel Seehof, Arosa 15
Hotel Victoria, Bale 15

Instruments for Travellers.
Cary, Porter, Ltd. .....
Clarkson & Co. 8

Insurance.
Eagle Insurance Co. ..... *Cover* 3
London and Lancashire ..... *Page*
Scottish Provident Institution ...

PAGE

Medicines & Medicine Cases.
Browne, Dr. Collis 12
Burroughs Wellcome & Co. *Cover* 3
Dinneford & Co. .....
Evans, Lescher & Webb, Ltd. ... 6
Mansfield .....

Naturalists.
Watkins & Doncaster 6

Outfitters.
Cellular Clothing Co. 12
Dowie & Marshall 13
Griffiths, McAlister & Co. *Cover* 3
Silver, S. W., & Co., and Benjamin Edgington .....
Taylor & Glassey .....
Tucker, Joseph .....

Photo Engravers.
Bale, Sons, & Danielsson, Ltd.

Photographic.
Burroughs Wellcome & Co. .....
Marion & Co., Ltd. .....
Newman & Guardia 6
Rose, Ltd. .....
Sinclair, J. A., & Co. .....
Stereoscopic Co. .....

Portable Buildings.
Harbrow, W. 9

Publishers.
Constable & Co., Ltd. .....
Heinemann, Wm. ..... *Page*
Macmillan & Co., Ltd. ... .
Murray 11
Philip, G., & Son, Ltd. 5
Potter, Wm. 3
Stanford, Edward ..... *Cover* 2
Travel and Exploration 3
Witherby & Co. 3

Railways.
Great Central Railway .....
Great Eastern Railway .....

Razors.
Kropp Razor ..... *Cover* 2

PAGE

Soaps.
Wright's Coal Tar 4

Sporting Outfits.
Burberrys 7

Stores for Expeditions, &c.
Griffiths, McAlister & Co. *Cover* 3
Silver, S. W., & Co., and Benjamin Edgington .....
Spratt's Patent, Ltd. .....
Tucker, Joseph .....
Wilkinson Sword Co. .....

Stoves.
Peers, Wm., & Co. 15

Tailors.
Skinner & Grant .....

Tents.
Burberrys 7
Piggott Bros. & Co., Ltd. .....
Silver, S. W., & Co., and Benjamin Edgington .....
Tucker, Joseph .....

Tobacco.
Player & Sons .....

Tours and Excursions.
Cook, T., & Son 9
Orient Line 5

Turkish Baths.
Nevill's, Charing Cross ..... *Cover* 3

Typewriters.
Blick 14
Oliver Typewriter Co., Ltd. .....
Remington Typewriter Co. .....

Wines and Spirits.
Deutz & Geldermann .....
Haldsieck, Charles .....
Martell & Co. .....

BOOTS FOR EXPLORERS.



(REGISTERED AT STATIONERS' HALL.)

DOWIE & MARSHALL

(Established 1894)

Have for many years made a special study of the various kinds of boots required for different climates, and they have had the gratification of pleasing many Travellers, including members of the R.G.S., from the time of Dr. John Rae of Arctic renown to Sir H. M. Stanley, the African Explorer.

Country Customers should send, as guide to measurement, a pair of old boots and outlines of the feet.

Only the best hand-sewn Boots are made.

455, WEST STRAND, LONDON.

G.P.O. Telephone No. 9015 Central. (3 doors from Trafalgar Square.)

Telephone No. 5197 Gerrard.

MARTIN, HOOD & LARKIN,

MAP SPECIALISTS,

Lithographers and General Printers,

61, NEWPORT ST., LONDON, W.C.

ALL KINDS OF

Maps, Plans, and Charts.



DOULTON'S

1909 Patent

TRAVELLER'S PUMP FILTER

ASSURES

Pure Drinking Water

Vide *British Medical Journal* and *Journal of Hygiene.*

OBTAINABLE THROUGH ALL STORES AND OUTFITTING HOUSES.

ROYAL DOULTON POTTERIES

vellers to either Pole, and most of all to the intervening parts of the ld, will find the "Blick" the most portable, reliable, and hardest wearing hine. It has been called the Special Correspondent's "light-weight travelling panion," and has stood the test of rough travelling through the South African t, the wilds of Klondyke, China, the Congo, Soudan, and "The Forbidden Land."

The "Blick"



¶ The "Blick" is the easiest Typewriter to learn—an hour does it. It is very light, 9½ to 14 lbs. in its wooden case—less in leather. The writing is always in sight, and it is so strong and simple in mechanism that it seldom gets out of repair. In a word, it possesses the efficiency of the big cost machines at half the price.

Price 9 to 13 Guineas. Cash Discount or Easy Terms.

Write for Booklet No. 85.

The BLICKENSDERFER CO., LD.

9 & 10, Cheapside, London, E.C.

NEAR THE SOUTH POLE.

Sir E. H. Shackleton's Christmas Dinner.

In Sir E. H. Shackleton's great book, "The Heart of the Antarctic" (Heinemann)—the most fascinating book ever published on Polar exploration—appears the following tribute to OXO.

"We had a splendid dinner. First came "hoosh, consisting of pony ration boiled up "with penguin and some of our OXO and "biscuit. Then in the cocoa water I boiled "our little plum pudding, which a friend of "Wild's had given him. This, with a drop of "medical brandy, was a luxury which Lucul- "lus himself might have envied; then came "cocoa, and lastly cigars and a spoonful of "creme de menthe sent by a friend in Scot- "land. We are full to-night, but this is the "last time we will be for many a long day."

OXO

OXO, 4, Lloyd's Avenue, London, E.C.

The

Geographical Journal.

No. 3. MARCH, 1910. Vol. XXXV.

A JOURNEY IN NORTH-WESTERN ARÁBIA.*

By DOUGLAS CARRUTHERS.

DURING the last twenty-five years our knowledge of the interior of Arabia has not been increased in any way. Although Arabia still possesses the largest tract of unknown country in the world, it has been neglected by travellers, and its exploration has been at a standstill for a quarter of a century. In 1908, however, Captains Aylmer and Butler opened up new ground in Northern Arabia, filling in a long existing blank between Bagdad and Jauf. Mr. D. G. Hogarth's paper in the *Geographical Journal* for December, 1908, also drew attention to the remaining fields of exploration in South-Western Asia, and more especially in Arabia. I therefore determined to make an effort to travel over and map out the blank that exists between the Hejaz railway and the Wadi Sirhan, to determine the western limits of the Great Nafud, and to visit the oasis of Teima. Thence I proposed to proceed to Hail, and if possible to follow the Wadi el Rumma down to its junction with the Euphrates river. Teima attracted me because it had not been entered by a European for twenty-six years, and the interest of Hail lay in the fact that there is no up-to-date account of the affairs of the rival Emirs of Hail and Riad, nor of the present state of Nejd.

In January, 1909, through the medium of the American College in Beirut in Syria, I obtained funds to enable me to plan an expedition in search of rare animals that inhabit the northern frontiers of Arabia. In fact, I might almost say that it was a rare antelope, namely, the Arabian oryx, which induced me to launch forth into those inhospitable deserts, and was the "load-star" that led me on across the deserts to the borders of Nejd, in Central Arabia. Although the chief object of my

* Read at the Royal Geographical Society, January 24, 1910. Map, p. 356.

journey was natural history, yet in a land so poor in fauna, I had time and opportunity to further geographical knowledge, and to render an account of these regions in the fullest manner possible.

In January, 1909, I set out from Damascus, and journeyed down the Mecca railway as far as the oasis of Tebuk, on the threshold of Arabia proper. From here I tried to pass into the interior, but found it impossible, owing to the hostility of the Beduin and the watchfulness of the Turkish officials. The Hejaz railway hinders the traveller rather than helps him, for the tribes are hostile to the building of the line, and Turkey has no power amongst the Beduin. Moreover, the pure Arabs of the oasis in the interior are still more watchful, and more determined than ever to stop any but Moslems from entering their "forbidden land."

I spent two weeks at Tebuk. The tribe of the Beni Atiye held the surrounding country, and although I was safe within their borders, I could not go further. So I returned to Damascus to seek an easier method of getting to my goal. My plan of action was to make friends with some powerful Beduin tribe, who could help me on my way into Arabia. In order to do this, it was necessary to find a man to act as guide and friend, and to introduce me to one of the great tribes. Such a man I found in Muhammad Mirawi, a native of Damascus, who had wandered all over Arabia, and had come in contact with most of the great tribes. He had acted as camel-dealer and transport agent for the Haj to Mecca, and had even traded camels from Central Arabia for the Egyptian Government. In fact, being a man of importance, he seemed to suit my purpose exactly, and I engaged him. He was an old man, too old, it seemed, to be setting out on such a journey; but age is greatly respected amongst the Beduin, and his knowledge of the affairs of East and West made him a very superior person amongst the ignorant nomads, who, however, always have a thirst for knowledge.

In Damascus I bought up camel-saddles, water-skins, and such food as rice, flour, coffee, and sugar; rifles and cartridges for my men, and a few presents of clothes for the Beduin. In fact, I bought everything I needed for a journey in a foodless and waterless country. It was necessary for me to change all my money into the Austrian dollars (the Maria Teresa), which are in demand all over Central Arabia in preference to the Turkish money. My only need then was transport, and this I could not get except among the Beduin, for I wanted dromedaries of the finest breed. Thus I had to introduce myself to one of the great tribes that hold the borderlands, and own large herds of camels. For without these a journey into the waterless interior would be impossible. I chose for my purpose the tribe of the "Beni Sakhr," or "Children of the Rock," who hold the marches of Palestine and Arabia. Hearing that they were wandering in the neighbourhood of Katrane, which was an old blockhouse on the Haj route to Mecca,

and is now the position of a station on the Hejaz railway, I made use of the train as far as the village of Jesi, some 40 miles to the north of the former place.

Jesi is situated about 22 miles due east of the Dead sea, in the Belka country, and is of interest as being the limit of cultivation. To the east of this all is desert. This country is a transition stage between the "desert and the sown," the rolling downs are covered with a certain amount of growth, and in the spring there is very good pasturage. Indeed, all the year round there is sufficient to support large herds of camels and flocks of sheep and goats.

The "Belka," then, is the headquarters of the Beni Sakhr, and from it they get their strength and wealth, for they have a good land to fall back on, with a certain good supply, and are not dependent on the open desert with its shifting and uncertain pastures. This is their base, where they can keep their herds in safety and without fear of loss from drought, and it is from here that they range over the country to the eastwards.

The "Beni Sakhr" tribe have the reputation of being the boldest robbers, for their numbers are great and, being rich, possess good rifles, therefore I thought it prudent to make friends with the strongest tribe. The exact range of the Beni Sakhr is from the Druse country south of Jebel Druse to Maan. The declivities of the Jordan valley and the Dead sea form their western boundary, whilst eastwards they wander as far as the Wadi Sirhan. South-eastwards they occasionally make use of the Sherrarat country, with which tribe they are allies, but their migrations in that direction are limited by the territory of the Howeitat, their most deadly enemies. The Beni Sakhr are true nomads, in that they do not cultivate, and always live in tents; but they are of a less migratory habit than the tribes, such as the Roala and Sherrarat, who wander over the inner deserts.

On my arrival at Jesi, I found that the Beduin were encamped in the country to the south-east, and with the aid of a party of Arabs going out to join the tribe, I eventually found myself, after a journey of thirteen hours, drawing within view of an immense encampment of Beduin. There were probably a thousand tents scattered over the boundless waste, pitched in long lines in the wadis, or in any slight depression which would protect them from the wind. Over the surrounding country immense numbers of camels wandered, herded by half-naked Beduin boys. I sought the tent of the sheikh, Hathmel ibn Zeben, who proved a good friend, and showed true Arab hospitality by entertaining me and my men for three weeks.

By living with the Arabs, doing as they did, and moving with them in their migrations, I obtained an insight into their mode of life and customs, which helped me a great deal during my subsequent journey. I found them most friendly and willing to help, but I kept

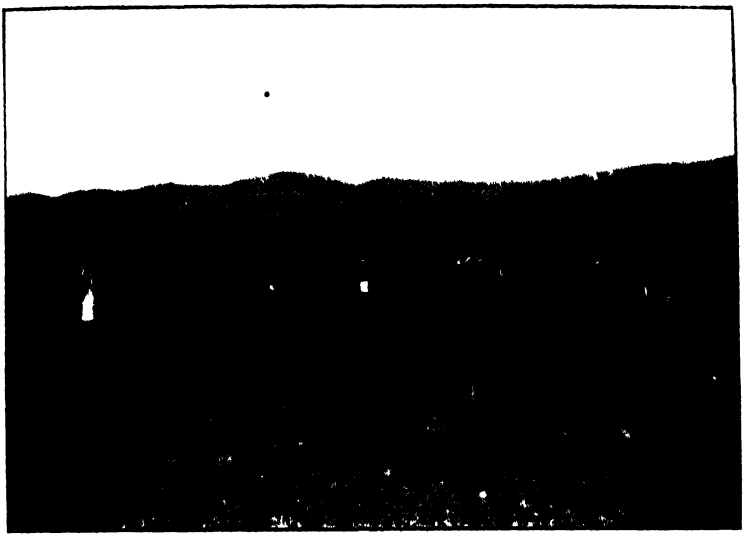
from them my real intentions, and only told them I needed to purchase camels for a journey. Things move slowly in the East, and I spent fourteen days in buying three camels! But the time was not wasted. I studied Arab manners, learned more or less how to eat with my hands, and how to wear Arab costume with some comfort, how to drink coffee *à la* Arab, and, most difficult of all, how to sit still all day long doing nothing. I found this last most trying, more especially because it was cold; a Beduin tent is a draughty place at the best, but in mid-winter it is almost unbearable. On two occasions there was snow on the desert.

We used to feed out of a huge round dish, ten of us at a time. The fare was camels' milk and bread in the morning, and in the evening we generally had meat and rice, cooked with an enormous amount of fat. During the day we appeased our hunger by sipping strong black coffee. At night there was always a large group of men in the tent of the sheikh, and talk was carried on far into the night. The vexing question of pasture had always to be considered, and when and whither the tribe should move. Small matters and tribal quarrels had to be settled, and there was never a day but news came in of the raids and warfare of the other tribes, news of the rival emirs in the heart of Arabia, and of the fighting between Turk and Beduin along the Hejaz railway.

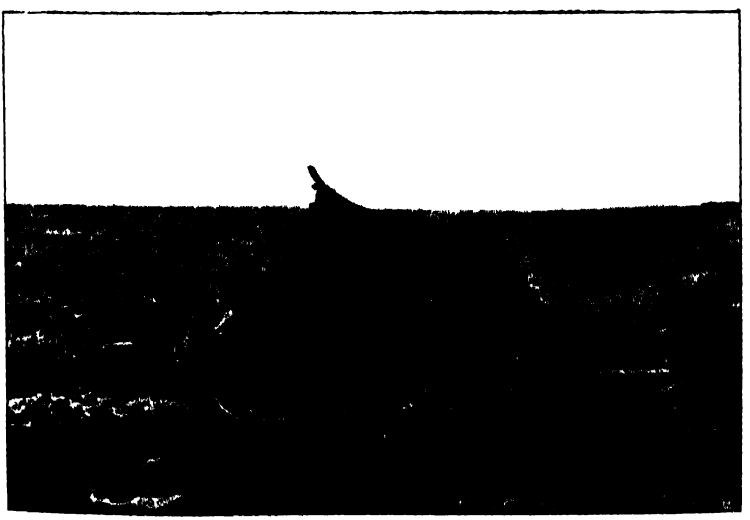
My man from Damascus was most popular at these evening discussions, for he always had some story to recount or some news to tell, and if ever there was lull in the conversation, he would be turned on to describe adventures he had met with on his travels. Eloquence is a highly prized talent amongst the Beduin, and not only would they recount their stories in the most beautiful manner, but on occasion, to the tune of a single-stringed violin, they would sing extempore songs for hours on end.

One day, when in our wanderings we happened to camp near some rolling country, the sheikh and I rode off in search of gazelle. We found a large herd, and being mounted on good horses we managed to ride them down, throwing ourselves off our horses for the shot, then galloping on again. We killed six gazelle in about an hour, and rode back to camp with enough meat for a big feast.

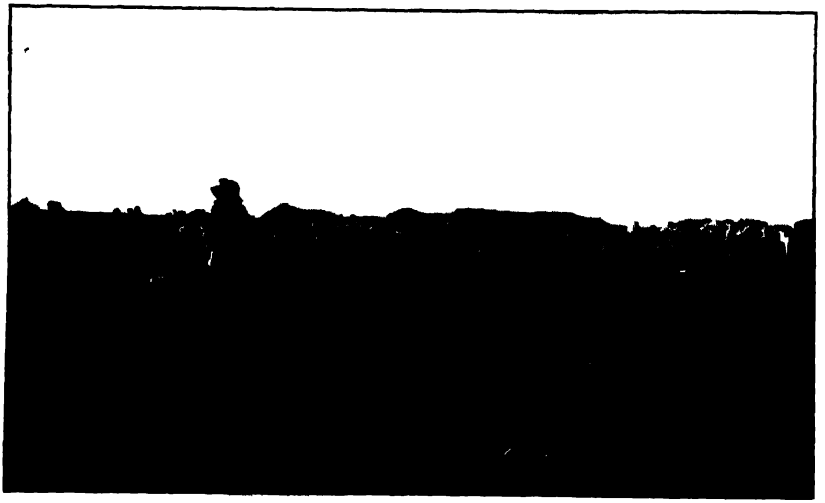
It is the custom that whoever kills game should provide a feast for all his friends. On the occasion of these feasts I noticed that there was always a crowd of hangers-on waiting at the end for a scrap of food—half-starved looking boys and ragged men. These were orphans, whose parents had been killed, or men whose herds had been "lifted" by other Arabs, and as a result they were destitute, for the law of the Beduin is "survival of the fittest" in its strictest sense. But the sheikh supplied food liberally, and I noticed that he always looked after the poor and fed the hungry.



THE GREAT TENT OF SHEIKH HATHMEL OF THE BENI SAKHR



SMALL TENT BELONGING TO THE SHERRARAT BEDUIN.



CAMEL-HERDS AT A WELL.



A BEDUIN WARRIOR (SHERRARAT TRIBE).

The tent that I lived in all this time was the ordinary black "beit," as used by all the nomadic tribes. It is interesting to note that the same name is used for "house" in the settled districts, a remnant of the time when all the Arabs were nomadic. The tents varied in size, but not in design. The poor Sherrarat had tiny little tents scarcely big enough to protect two people from the sun and wind, for they were nothing more than screens to shield the owners from the elements. An average tent measured perhaps 20 yards by 6 yards, but the tent of the sheikh was a structure that spread over a length of 36 yards by 8 yards deep. The colour was always dark chocolate-black, the back only being striped longitudinally with white. All the tents of the Beni Sakhr were like this, but the little tents of the Sherrarat were of a greater mixture of colour. The large tents were all divided across the middle by a brightly coloured curtain to partition off the women's quarters. In all cases the front of the tent is open the whole length. They are pitched facing to leeward, and if the wind changes round they merely take off the back and put it up on the other side, thereby changing the front of the tent.

This tribe owned immense herds of camels, a large number of sheep, and sufficient horses to mount all their fighting men. They live almost entirely on the produce of their herds, and have but little need of money. The camel provides them with meat, milk, clothes, house, and transport. Their whole lives are given up to the breeding of their flocks and herds, and to systematic robbery. The Beduin lives in his tent for a week at a time, or until the fit comes over him, and he calls his companions, and off they go on a foray to steal camels, in order to increase their own herds. The Arab's great idea is to possess a rifle, for that means power. In order to do this he must steal camels. So, having stolen camels, he purchases a rifle; then come more raids to take more camels, this time in order to buy a wife. Camels are their sole means of exchange.

During this time we constantly changed camp, and wandered across the desert in search of new pasture, for the grazing was not sufficient in any one place to support the herds of camels for any length of time. At dawn I used to find the camp astir, and the tents being taken down by the women, and rolled up into huge bales, while the boys herded the camels, and the men loaded them up with the household impedimenta. When the camels were laden, the small children were lifted on to the top of the loads, where they seemed perfectly at home. Then, when all was in readiness, the migration began, and each family, with its own compact little caravan, set off across the desert.

One by one each little home was packed up, and moved off to pastures new. First of all went the camel-herds, driven by lads and lasses; these were followed by the camels, laden with the tents, camp-kit, and small children; the women walked by the side, or rode,

perched on the top of a tent-load, singing wild Beduin songs as they moved, heedless of their poverty, but revelling in their freedom. The men, armed and on horseback, rode far in advance or at the rear on the look-out for enemies, scouting the country in search of pasture, sometimes indulging in a course after a hare with their greyhounds, or loosing their falcons at a "houbara" bustard. Hares, bustard, sand-grouse, and gazelle abounded on these rolling plains, and I saw many a pretty hunt with hound and hawk.

It is a fine sight to see a large encampment on the move, imbued with the spirit of "divine unrest." The Children of Israel must have presented just the same spectacle when they wandered of old from well to well, for the Arab never changes. When the chief finds a suitable grazing-ground, he lights a fire as a signal to the rest of the tribe, who are scattered over a large stretch of desert. The smoke of the fire shows the nomads the position of the chief's tent, and they gather round and pitch theirs in groups, generally in depressions to get shelter from the wind. It takes very little time to put up the tents and to get everything in order, and then the Arabs lie about and talk and drink much coffee, until the spirit moves them to go on a foray, or necessity forces them to shift camp again.

One evening the monotony was varied by the scare of an attack by a hostile tribe, and the news was passed through the camp in an incredibly short space of time, the cry for horsemen being taken up from tent to tent. The whole camp was in a turmoil in a second. Every man who owned a horse, or who could borrow one, armed, mounted, and galloped off, the women standing at the tent doors to wave them farewell. Men who had no "mounts" went on foot, and the boys were busy herding the camels nearer to the tents, for in Beduin warfare the camp itself is never entered, nor are the tents molested. Thus all able-bodied men can go off to fight, and leave the camp without fear of their belongings being pillaged. The scare turned out to be nothing in particular—a passing raiding-party had chanced on our encampment, but had beat a hasty retreat on finding out our numbers and strength.

As of old, the Beduin's "hand is against every man's." They are daring robbers, and think nothing of killing if ought is to be gained thereby. They have, indeed, reduced robbery to an art, and their one alleviation from the dull monotony of life is systematic robbery. These desert-rangers correspond exactly to the polite highwaymen of our own English high-roads of a hundred years ago. They are always spoiling for a fight, and the young Beduin, who are at all ambitious, find this their only means of becoming powerful.

A rifle is the wish of every young Arab, and, when he has got this, he enters on a career of plunder, in order to possess a good number of camels. Every Beduin in Northern Arabia owns a breech-loading

rifle. I examined a great number of these, and found them to be chiefly of British manufacture. There were also a fair number of American rifles, and a few French.

I seldom saw a Beduin praying; in fact, they seemed to me to be utterly careless of religion, and it is certainly remarkable that, although Arabia is the centre of the Moslem world, yet a third of its inhabitants care nothing for Islam. The nomads are not religious, and never were; they would rob a Mecca pilgrim as readily as they would a Christian. Mohammed never converted the nomad tribes.

During my stay with the Beduin I had been endeavouring to buy good camels for my journey. The remark that I wanted camels drew out long stories of record rides, and extraordinary distances covered without water, arguments as to the best breeds of dromedary, and their respective qualities. Camels form the chief concern in the Arab's existence, for, as I have said, they supply him with all his wants, and even his wife is purchased by means of camels. Hence the breeds are well selected, and the pedigrees carefully kept. There are several well-known and highly prized kinds, and I endeavoured to obtain the best, for my journey was to be of the severest nature, and if the camels fail in a waterless country, the results are apt to be disastrous. Many camels were brought to me, but most of them were refused, for I had an expert buyer to bargain for me who knew all the tricks of the trade, and so one by one three well-bred female dromedaries in the finest condition were bought at a cost varying from £11 to £16 apiece.

By this time I calculated that my position was about 20 miles east of Katrane. All the country to the east was unknown, and I saw that by making this my "taking-off" place, I should break new ground to the borders of Nejd, in Central Arabia. It is true that an Italian, named Guarmani, passed this way on his way to Nejd some forty-five years ago, but his account of this region is very vague. His route lay to the west of mine, and although he described in detail the tribes he met with, and his narrow escapes from marauding Beduin, of geographical information he gave us very little indeed.

This country has also been described by Tristram, who in 1872 reached the Haj route near Khan Zebib, during an exploration of the Land of Moab. He ventured no further, but described the unknown deserts to the east by hearsay, "After three days' journey across the White or limestone country is a region of black basalt, 'a land of black stones.' This he describes as being two very long days across, and he thinks, but is not sure, it is about three days' journey from north to south; this volcanic region he calls El Hhurreh. Beyond this black stone country eastward are two days more of white ground, hilly, but with good camel pasture, and then begins a desert with nothing on it but antelopes and wild cows."

A new difficulty presented itself at this moment: I could not persuade

any Beduin to accompany me, and act as guide across the waterless desert that I now had to face. One and all refused on the grounds that I was a Christian and therefore certain to be robbed, and that, if any harm came to me, they would be accused of having had a hand in it. At last, with great difficulty, I induced the chief to give me one of his own men, a huge "Sherrari" of the Sherrarat tribe, who eventually proved invaluable.

My arrangements being completed, having packed my goods into sacks, filled my four water-skins, and watered the camels for the last time for many days, one evening after dusk the four of us mounted on four camels, left the homely tents of the "Beni Sakhr," and set out into the night. We travelled far that night, in order to get across the danger zone that exists along the coasts of the desert sea, sleeping for a short time before daybreak, after which we pushed on again, and rode all day.

I now kept my observations as best I could, with compass and watch, noting every hour I rode, as well as the pace and direction. On camels one travels very straight, and at a very even pace, making a perfectly straight line across the boundless desert, from horizon to horizon. During the first day's ride—that is to say, at about 45 miles east of Katrane—a remarkable change took place in the nature of the country. (I use this place as a base from which to count my distances, for it is the only place near my starting-point that is well marked on all maps.) The limestone steppe changed to black desert, the rolling country, bearing a certain amount of growth, suddenly stopped, and before me was an immense smooth plain covered with rounded flints, destitute of vegetation except in the wadis. The small amount of animal life which was to be seen in the "Belka" country here became still less. No gazelle or bustards enlivened the dreariness of the scene, but there were a few small birds, and occasionally I started desert hares.

There is a good landmark for travellers, which also serves to mark the junction of the limestone and the flinty deserts. It is a group of three little hills, standing up out of the desert, and visible at a long distance—"Thleithuwath" the Arabs call it. To the north of this is another small ridge which the Arabs have named "the end of the flints," for Arabians from the far interior, coming up to Damascus, here leave the black stony desert, and arrive at a less forbidding type of country. Then followed several hard days of travel across the black desert called "Ard-es-Suwan," or "the desert of flints," by the Beduin. I steered a course south-east by south, and kept a very direct line.

The nature of the country was that of a wide plain, gently rolling in great folds, which, however, looked perfectly level as a whole. It was a smooth limestone floor, sprinkled over evenly with countless flints, worn smooth by the action of wind and weather, polished and glistening in the sun. Here and there sandstone spires and quaint pyramidal hills, which served as landmarks, stood up out of the desert. This great



THE "ARD-ES-SUWAN," OR "DESERT OF FLINT."

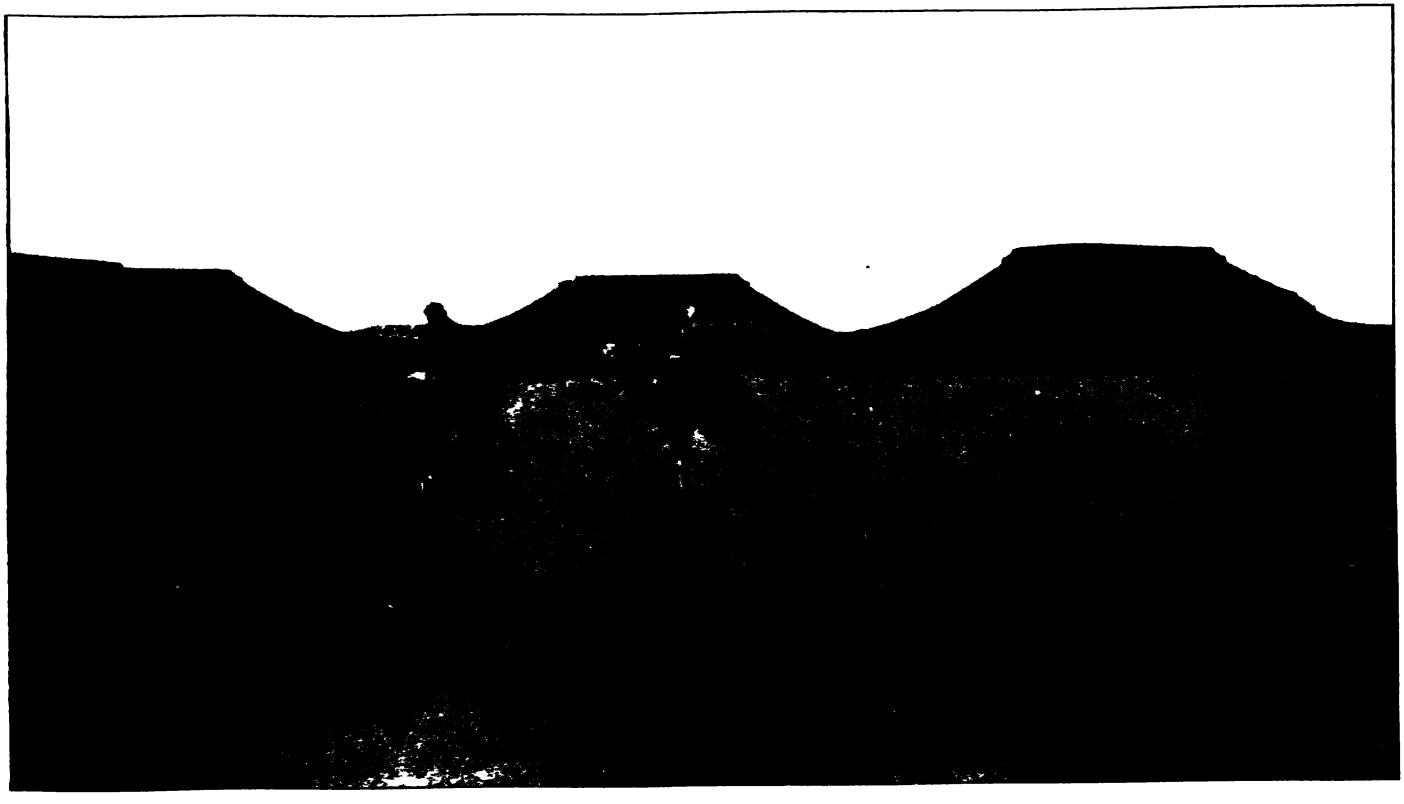


TABLE-MOUNTAINS IN THE "ITBAIK" REGION.

black desert is not entirely featureless. The Beduin have names for every physical feature, every wadi, pasturage, and depression, every little hill and curiously shaped rock—all are considered worthy of name and notice. The altitude was high, for day after day my aneroid registered above 3000 feet, and there was very little variation in the altitude for the first five days.

The line of demarcation between the limestone and basalt deserts also marks the limit of that country where dew falls and where it does not. To the south of Wadi Bayer, the Beduin say, no dew falls, and I can testify that during the whole journey I slept out in the open and never found my clothes in the least damp.

There were many wadis intersecting my route, all of which trended in a north-easterly direction, and all flowed to the Wadi Sirhan. Three of them were especially large and important wadis, namely, Wadi Bayer, Hausa, and Hidrij, composed of deep steep-sided watercourses, and containing a considerable amount of vegetation, tamarisk, and thorn-scrub. In the dry water-channels were piled up heaps of dead wood and old trees, washed down by sudden floods. Although this land appears so sterile and rainless, yet sudden storms occur, which fill the wadis to overflowing, and cut deep channels. In these wadis is collected all the animal life that exists, and I found innumerable colonies of sand-rats, which honeycombed the ground to such an extent that the camels sank in up to the knee-joint. These I trapped at night, for we generally slept in the wadis, and I used to skin them as I rode along the next day on camel-back.

I should much have liked to stop and collect specimens of all the fauna that inhabited this region, but lack of water forbade it, for I only had sufficient for six days. The few birds to be seen were the desert scrub-warbler (*Scotocera inquieta*), a chat (*Saxicola leucopyga*), two species of larks (*Calandrella brachydactyla* and *Otocorys bilopha*), the raven, and the ostrich. This last was an interesting discovery, for no traveller except Palgrave has mentioned sighting them in Arabia, although they have been reported by the Beduin. Presumably it is the same as the North African variety (*Struthio camelus*), and its occurrence in Arabia is an interesting example of a genus peculiar to Africa ranging into Asia. I saw three in the Wadi Hidrij, which is, roughly, 120 miles south-east of the Dead sea. They are found all over the interior of Arabia, but this is probably their most northerly limit. Ravens seem to find a living in the most desolate localities, and on one occasion a pair of these birds followed us, as we travelled, for a whole day across the desert, stopping when we stopped to eat, picking up the crumbs after we had left, and then following on behind.

For six days we never saw any signs of human beings, but that this region is crossed and recrossed at certain seasons by large numbers of Beduin, is evident from the well-defined tracks that mark the

desert. The surface is hard and strong without any sand to blow about and cover up traces of footprints, and at the same time it is too hard to take an impression easily, yet the desert is tracked in all directions by smoothly worn paths, which are probably of an immense age.

To show the immensity of this land and the ease with which one could lose one's self, I may mention that we had to travel a whole day's journey without in the least knowing where we were, until my guide could pick up his bearings. Then he sighted a hill shaped like a camel-saddle just showing above the horizon, and knew our position exactly. At night we travelled by the guidance of the stars, for it was often necessary to push on at night as well as in the day. My usual plan was to travel from sunrise till eleven o'clock, then rest for two hours, and travel again till five in the evening, when we took a meal and rode on for a couple of hours in the dark before stopping for the night's sleep. I never used a tent, there was no need for it, the climate was perfect. I always slept as the Arabs did, on the ground, wrapped up in a sheepskin coat, beside my camel.

The camels during this trek had no water, of course, and very little to eat, for they never had more than two or three hours to graze every day, and there was not always sufficient to eat. This is the reason why the best camels in the finest condition at the outset are an absolute necessity. I repeatedly took these camels for periods of six and seven days without water. Nine days is the recognized limit in Arabia whilst travelling, but herds out grazing in the spring months will go for a much longer period (three weeks, it is said). In the colder climate of Central Asia the Bactrian camels will endure for nine days. I mention this because there seems to be much misapprehension as to the abilities of camels to exist without water. A recent writer in the *Times* states that "in Arabia the breed (of dromedaries) appears to have deteriorated, for here they will thirst perhaps for three days, after which they die, protesting. . . ."

On the sixth day after leaving the tents of the Beni Sakhr the black desert ended, and I entered a region of sandstone. The whole aspect of the country altered, and before me stood a prominent range of hills, where water was said to exist, and our water-skins being empty we hurried on. The wadis now drained to the west instead of to the east into Wadi Sirhan, and I eventually found a large depression situated north of the hills called Itbaik, to which they all flowed. The well was situated in a wadi called Hausa, which is surrounded by steep hills, an outlying spur of a more extensive range further on.

Wells in such a country as this rank as a most important feature, for they make possible the existence of a large nomadic population. One well in a waterless region will support any number of shepherds, and will enable them to use as a grazing-ground a country which would otherwise remain uninhabitable for lack of drinking-water. I found

the well of Hausa to contain the most excellent water at a depth of 40 feet.

We watered our camels and filled our water-skins as quickly as possible, for the wells are still the most frequent causes of quarrels, as in the days of old. But, quick as we were, we had an exciting moment when suddenly four Beduin appeared riding down on us in a threatening manner. They called on us to stand and deliver. But we, being the stronger party, were on the point of firing, when my guide suddenly recognized his own tribesmen, and all was well. The next minute the Beduin were kissing each other. The robbers were of the Sherrarat tribe, scouting the country on the look-out for plunder. If I had not had a man of their tribe with me there would have been a fight, and somebody, probably myself, would have lost his camels, and been left stranded in the desert. An ominous number of graves dotted the ground around the well, showing where others had been less fortunate.

In the neighbourhood of this well I saw much game. The hills were inhabited by many ibex (*Capra sinaitica*), and I saw some carrying very fine horns. Gazelle also were numerous here, and seemed to prefer the hill country to the open desert. I found tracks of the "cheetah," and came on the first clear traces of the Arabian oryx (*Oryx beatrix*). I left the well and went some way to the south-east, where I camped in order to hunt the surrounding country. The whole of this region belongs to the Sherrarat tribe, but, not being powerful, they are unable to hold it against strangers, with the result that many Beduin range over this area and render the country unsafe. It is neutral ground where many a fight takes place. Four great tribes wander round its borders, the Roala and the Beni Sakhr on the north and north-west, the Shammar on the east, and the Howeitat on the south-west. The Sherrarat, in order to save themselves from constant harrying by these stronger tribes, have become allies with them. Whenever I came across Beduin of the above-mentioned tribes, I found small encampments of Sherrarat pitched alongside of them. They are the poorest of the poor, and their tents are nothing but a shelter from the wind and sun, sometimes not sufficient to protect the whole family at once. They are fine hunters, however, and excellent shots, as their country is full of game. They also have the peculiarity of being mostly left-handed.

There are evidences to show that the interior is becoming more dry, and as a natural result the nomads find it more difficult to support themselves, and are therefore dwindling in numbers or seeking the protection of the semi-nomadic tribes who live on the edge of the cultivated lands. It is said that the Sherrarat were once a large and powerful tribe, and that their country was a "good land"; but the drought came, their herds died, and their country, which was once good pasture-land, became dry and useless. This they told me themselves, and went on to

say that, as a result of the prolonged drought—it lasted seven years—their tribe divided, and the greater part migrated to Tunis. I asked them when that was, and they said, "In the days of Mohammed." This remark seems to be of the greatest interest, for it is evidence as to the desiccation of Northern Arabia. The date they gave me, the days of Mohammed, would be about 600 A.D., and this corresponds with Prof. Huntingdon's conclusions as to the desiccation of Central Asia, namely, that the period from 300 A.D. to 800 A.D. was the time of the greatest desiccation and lessening of the rainfall, which caused the western migration of the inhabitants of those regions.

Such a drought as this would affect the Sherrarat more than the other tribes, for the Sherrarat hold a region which is wholly desert. Without large wadis, where there is always pasture or oasis, they have nothing to fall back on, as the Roala have in the Wadi Sirhan, or the Beni Sakhr in the Jordan depression. Lady Ann Blunt also tells of a legend she heard in Nejd, to the effect that there was a great famine in Arabia, and the tribes migrated to Tunis.

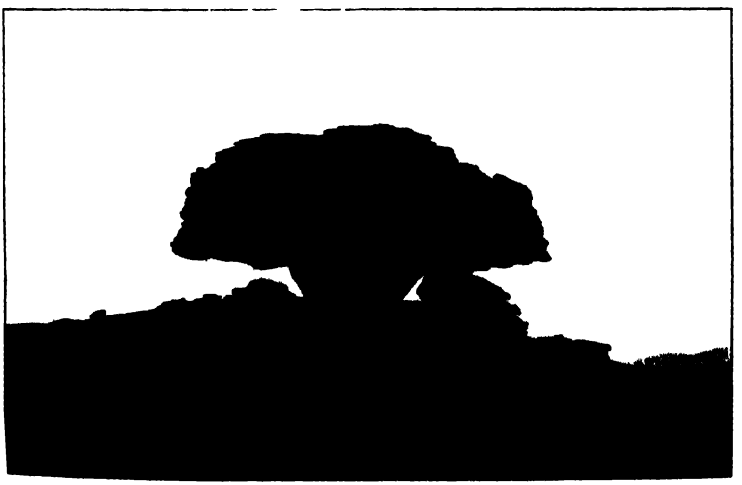
I now reached a most interesting region called "Itbaik," which I am of an opinion is the same as the range of hills mentioned by Doughty on hearsay. He called it "Tobeyk," and it is placed somewhat vaguely on the map, rather to the north of its real position. He described it as being as high as the Irman mountains in Nejd, and as being snow-covered in winter for a considerable time. I found it to be a sandstone range, with erupted basalt rocks on the desert at the foot of the hills. The hills were a mixture of sandstone, worn black by weather, and of lava-capped sandstone piles, all of which had the appearance of flat-topped table mountains. Some of these were perfectly black, and looked like immense cinder-heaps, while others were of red sandstone, with only the lava-cap showing black at the top.

The range ran east and west. Towards the east it soon faded away and was lost in high rolling country of sand-dunes and sandstone rocks; to the west it rose up, and appeared to culminate in higher peaks of about 4000 feet. At the point where I crossed the range my aneroid registered 3600 feet. In the valleys and among the hills the ground was silted up with red sand, and there was much less vegetation on the south side than on the north. In this region of sands appeared the first "ghada" bushes, a species of salsola, which grows all over the inner sand-desert of Arabia. I think that this range of Itbaik is continuous with the ridge which borders the Hejaz railway on the east, and possibly with Jebel Sherora, that one sees to the north-east of Tebuk.

Leaving the hill country, and dropping again on to desert, after two days I found the wells of Mghairah. These wells contained good water, but of a very red colour; it was not far below the surface, and there were many well pits. Here I fell in with the main section of the Sherrarat tribe. Some two or three thousand camels were driven in to



A BEDOUIN OF THE SHERARAT TRIBE



WIND AND SAND-WORN ROCK, WEST OF THE GREAT NAFUD



HOUSES IN THE OASIS OF TEIMA.



AN ARAB OF TEIMA.

be watered at the wells. I was struck with the extreme poverty of these Beduin, for their tents were miserably small, their food was abominable, and the sheikh did not even have any coffee. They possessed some black camels—the first I had seen—and they also had some exceedingly fine white dromedaries. The Sherrarat are considered the most skilful hunters, so I tried to persuade a hunter to accompany me, but they all seemed afraid to go in the direction I indicated because of the Howeitat tribe, who were out raiding.

At this encampment I was paid the greatest compliment that can be offered to any stranger. A young camel having been killed for the evening meal, the women collected the blood in a bowl, and, with a switch of dry grass, they painted long streaks of blood on the necks and flanks of my camels. In the dry climate the blood remained on for a very long time, and acted as a talisman amongst all the Sherrarat Beduin. In this camp I saw the strange sight of a camel carrying large saddle-bags, in one side of which were two babies, and in the other a baby camel!

"Man wants but little here below," but the Sherrarat have reduced their wants to a minimum. A Sherrari I engaged as a hunter possessed nothing in this world except his camel, saddle-bags, rifle, and the clothes he stood up in. He travelled with me for a long time, and never even had an extra covering at nights, although the weather was terribly cold.

The Sherrarat are all very good shots, and it is a common saying amongst the other tribes that a Sharrari is equal to three other men in a fight. Their skill in tracking is also very great, for these nomads, like the Red Indians or the Hottentots, have reduced the practice of tracking to a science. Half the life of a Beduin is spent amongst the camels; from early childhood, when he is sent out to guard the herds, until he is too old to ride out on raiding expeditions, camels form the chief concern of his existence. They are herdsmen by profession. Without the camel, life would be impossible in the deserts of Arabia. Small wonder, then, that camel-talk is as interesting to the Arab as the camel itself. It is his only means of information, and, by constant practice, the true Beduin can read the footprints like a book; they are science and gossip to him. This art is called Athar.

On several occasions when travelling by night my hunter stopped his camel, and, after a short examination of some camel-tracks, exclaimed that it was a raiding party of such a number and of such a tribe, and on each occasion I proved him correct. In daylight he could determine the exact number of camels from a mass of tracks all going in one direction, and could also say how long ago they passed and to what tribe they belonged. Marauding bands always leave a long, straight, compact line of footprints, as of men travelling fast, close together, and with an object. On hard, stony ground, where the camels leave little or no

impression, the dung tells exactly the time at which the owners passed that way, and probably the nature of the pasture, from which they deduce the extent of their wanderings.

Another most interesting custom of the Sherrarat is their habit of fortune telling. On every possible occasion, when in doubt as to the way, in danger of marauding bands, in want of water, or even when hunting and are in doubt as to the age of an antelope track, they proceed to tell their luck before venturing. It is simply done, by smoothing out the sand and making at hazard several rows of marks in the sand with the fingers. An even number is a bad omen, an odd number a good.

On leaving the wells of Mghairah a new type of country faced us. This was the region immediately west of the Great Nafud sand-desert, where I entered a very weird area of wasted sandstone hills. It was as if the whole country had been swept away by the continual westerly winds that always blow here with great violence. The ground was covered with wind-worn rocks that stood up in hundreds like giant mushrooms. In other places the dominating feature of the landscape was the table-mountains. These are of volcanic core, but outwardly appear to be sandstone. They are black at the summit, whilst the sides are red. Long ages ago the whole desert was at the same level as the top of these hills, but the continual wasting away and drifting of the sand towards the east has lowered the level of the country, and only the hard volcanic spires remain. The result of this wasting has gone to make the great sand-desert that has formed in the centre of Arabia, and which is called "Nafud." The true "parents of the Nafud" are, however, further west than this—the high ranges of wasted sandstone that border the Hedjaz railway.

Passing to the east of the well of Fajr, and safely through a mixed encampment of Roala and Sherrarat, I entered on the last stage of my journey before reaching the first oasis. The land became more barren. There was scarcely any camel-feed at all, neither had I any success at hunting, although I followed one herd of oryx for three days. We found on one occasion the traces of a fight between the Shammar tribesmen and the Roala, which showed that we were getting within the boundaries of the Emir of Hail.

To show how complicated are the intrigues of the various tribes, I might say that the Roala Beduin are enemies with the people of Teima and with the Shammar tribesmen, and yet they are friends with the inhabitants of the oasis of Jauf, who are themselves adherents to the Emir of Hail, and indirectly with the Shammar and Arabs.

On the eighteenth day after leaving the tents of the Beni Sakhr I sighted the oasis of Teima, the first town of any importance in North-Western Arabia. The oasis formed a large patch of cultivation in a glaringly white and absolutely sterile basin. We rode down and boldly

entered the oasis, being entertained by one of the leading families, relations of my Damascene friend who accompanied me.

So far everything had gone well, and I had passed through the Beduin tribes without hindrance, but I had yet to deal with the fanatical settled population of the oasis of the heart of Arabia—the pure-blooded Arabs. My intention was to remain in Teima until I could procure guides and protection for my journey to Hail, but my plans were suddenly upset by the Governor of Teima ordering me to leave the oasis immediately. He also sent his armed servants to turn out all my baggage, and to rob me of all the money they could find. This they did. Finding me quietly sitting in a tent pitched in a garden under the palms, they covered me with revolvers, tore open all my baggage, and took everything that they fancied. They did not find much, however, for I had already taken the precaution of stowing all my valuables in the harem of my host's house, where everything, in Arabia, is as safe as in the Bank of England.

However, on one pretext or another, I managed to remain in Teima five days, in spite of daily warnings from the governor to "quit." He also made insinuating remarks to me as to the fate of the last European who visited their town—Huber—who was here in 1863, and was eventually murdered.

Although the governor, the representative of the Emir of Hail, behaved thus, the inhabitants were, on the other hand, quite friendly. My host proved his Arab hospitality to the fullest limit, and was willing to endanger himself rather than turn away a stranger who had come to his house.

The chief impressions I gathered of this ancient oasis were, the extreme cleanliness of the houses, the great size of their halls, the wonderful water-supply, and, I might also add, the beauty of the women. The halls are of such a size that when occupied by twenty or thirty men they still look empty. The rooms are high and lofty, with roofs of palm or tamarisk rafters, often supported by rows of pillars. I measured one room 40 feet by 30 feet, and 20 feet in height.

The chief sight in Teima is the great well-pit, the El Haddaj, rightly called the "Heart" of Teima, a well famous all over Arabia. It is of such a size, and so great is the flow of water, that ninety camels can draw water at once. By a clever system of skin-buckets and ropes passing over ninety pulley-wheels, this number of camels can work at the same time. Automatically the water is tipped out into stone troughs and is carried to the furthest corners of the oasis by irrigating canals. Day and night the water is being hauled up, and the constant creaking of the water-wheels resounds all over the oasis. Besides this well, there are at least twenty smaller sources.

This water, the natives say, comes from the volcanic country called Harra. It is without doubt a strong spring of pure artesian water,

which they have chanced to tap, which would otherwise flow unused all the way to the Persian gulf. There is apparently a great deal of water flowing across Arabia, but secreted in the sandstones far below the surface and hidden under its burning sands.

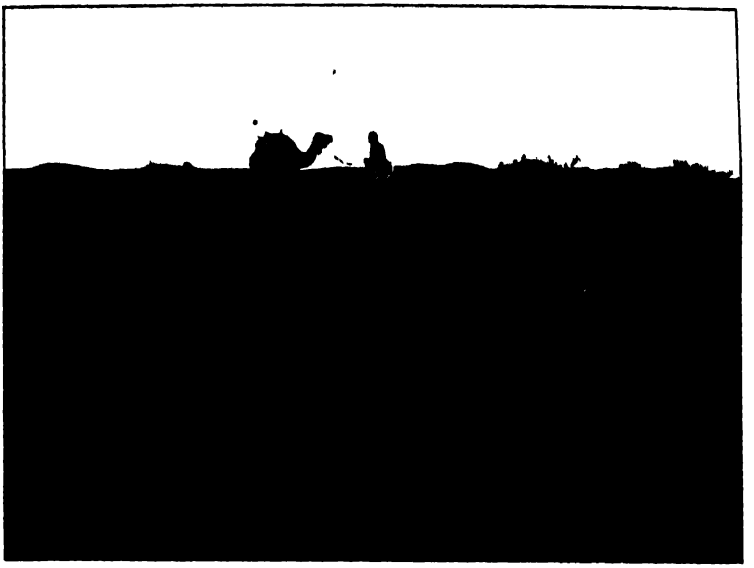
In the depression of Teima the water lies nearer the surface, and is therefore more easy to get at. By means of the water thus made use of, the inhabitants grow the following crops: barley, wheat, and a small quantity of millet; they cultivate the plum, fig, lemon, pomegranates, and gigantic citrons. Grapes they grow in small quantities, and, curiously enough, tobacco—a strange product for an oasis generally considered strong adherents of the Wahabi sect, whose tenets forbid them to indulge in luxuries and the use of tobacco. Dates, however, form the staple food of the inhabitants, and these seem to reach as near perfection as possible in this oasis. The date-stones are ground up and used for camel-food.

Another industry of Teima is the collecting of rock-salt, which is in general use amongst all the tribes of Northern Arabia.

The inhabitants of Teima are of the purest Arab breed, and very handsome in appearance. They appeared to me of almost a pale complexion after the Beduin, but this is not to be wondered at, seeing that they seldom leave the shadow of their palm trees, and never have to endure the burning glare of the desert. The men wore their hair in long curls, or in plaits, and they always shave the upper lip in orthodox Moslem manner, but as a rule they had scanty beards. Their dress varied but little from the Beduin, except that they carried swords instead of rifles. These scimitar-shaped swords were of fine workmanship, made at Hail, and the owners carried them constantly wherever they went. The natives seemed to me to be extremely suspicious, and zealous of guarding their oasis from intruding strangers, and they are just as suspicious of the Turks as of the Christians, especially now that the Hejaz railway passes within a two days' journey of their town. That the oasis of Teima is increasing in size is evident from the new plantations of young palm trees that are appearing on the outskirts of the older cultivation and the new walls encircling them. There is no reason why Teima should not increase in prosperity, for the water-supply is unlimited. The aneroid read 2800, 2900, and 3000 feet whilst I was in Teima, though Mr. Doughty makes it 3390 feet higher than this.

It seems impossible to give any estimate of the size of Teima, for there is no large block of houses or bazaar. Each man's house is situated in its own garden, surrounded by a high wall. At the time of my visit—the end of February—spring was in evidence at Teima. The plum trees were in blossom and the figs in leaf, and I also noticed many small birds on their northern migration.

Of the affairs of the Emirate of Hail I heard but little. The present



SAND-DUNES IN THE WESTERN NAFUD.



THE ARABIAN ORYX (*ORYX BEATRIX*), THE "WILD COW" OF THE BEDUIN.

Emir was a child of twelve years of age; at that time the country was being ruled by his uncle Hamud ibn Sebhan. While I was in Teima this man was killed, and no doubt sleeps with his fathers, whilst his cousin Zamil ibn Sebhan rules in his stead. Of the rival emirs, Ibn Soud was at that moment the stronger.

After five days the attitude of the governor became very threatening, and since I had no guides to accompany me to Hail, and the tribes in that direction were in a more unsettled state than usual, owing to the murder of their leader, I left Teima. Escaping by night, I struck due north and explored the western edge of the Nafud. The southern edge of the sand-dune area has been skirted by a few travellers, but its western limits were unknown.

Passing along its western edge, I determined the limit of the sand-dunes in this direction to within two days of the oasis of Jauf. The dunes begin in a most remarkable manner, rising up abruptly above the surrounding desert, so that one can walk in a few paces from the hard stony steppe on to the wild turmoil of sand-hills. At the edge of the dunes, half-way between Teima and Jauf, the aneroid registered 2300 feet, which corresponds exactly with Blunt's observations at the Nafud edge near Jauf. Mr. Doughty's readings on the edge of the dunes between Teima and Hail are much higher than mine, namely, 3495 feet. This greater altitude is accounted for by the fact that the general slope of Arabia is from the south-west to north-east, and that therefore the highest part of the floor of the Nafud is in the region where Doughty took his readings; also the sands themselves lie deeper on the south and south-west than they do on the north and east.

The sand-dune area itself is at a higher altitude than the bordering steppe, and one immediately rises on entering the sand-hills. The aneroid registered 2300 feet on the steppe, and 2600 feet on the first sand-ridges. Euting gives 960 metres as the altitude of the highest sand-dune, and Doughty makes a difference of 575 feet between the steppe and the sand-dunes. Thus the dunes stand up above the true level of the desert to a height of from 300 feet to 500 feet.

The sand-dune area, curiously enough, supports a considerable amount of vegetation, a heavier growth, indeed, than the surrounding desert. The Nafud is covered with the ghada bush, and a tall grass, called "knusi" by the Arabs (*Aristida forskahlei*), grows in some quantity, and is excellent feed for camels. There are also wide stretches of pure sand without growth. I have measured the roots of the ghada, where the sand has blown away and left them exposed, as 50 feet in length. I also found a curious parasite (*Cynomonium coccineum*) growing on the roots of the ghada bush, which produced a long spadix of the most brilliant red colour. As these are very juicy and full of water, the antelope that inhabit this waterless region dig in the sand in order to

get at them. It is worthy of notice that the Arabian oryx seemed to be most numerous where these parasites were growing. Another plant of parasitic habits found there was the *Phelipea lutea*.

All the dunes trended in a north-and-south direction, and the sides facing east were generally too steep for the camels to walk down. The sand was red and of an extremely fine texture, and I noticed that on the tiny sand-ripples the summits were composed of large grains, whilst the hollows were filled with very fine particles. I saw nothing of the curious faljes, or great horseshoe pits, which all travellers have remarked on in the centre of the Nafud. In the sand-desert itself there are no wells, but outside its limits on the west I found three, namely, Ubai, Huj, and Imleih. Only the last named was visited, and I found it to contain rather salt water at a depth of 20 feet. There were numerous well-pits. The well of Huj is between this and the Nafud, and is well marked by a hill shaped like a camel-saddle and called Huj Umkur.

The well of Ubai is also on the Nafud edge north-north-east of Teima. To the east of it there are some sandstone crags emerging out of the sands, called "Theithuwath Assafiyyeh" and "Hulwan Khunfi;" the latter is identical with Thulla Helwen mentioned by Doughty. These hills, like the crags of Jubbe on the Hail-Jauf route, are probably a confirmation of Euting's statement, as mentioned by Mr. Hogarth, that "the sandstone stratum of the Nafud is not infrequently emergent in the form of flat-topped hills."

The Roala tribe were camped in this region, and although I only came in contact with a small section of the tribe, I could not help noticing their superiority to the other tribes I had met. They appeared to be remarkably well to do, owning many horses, falcons, and hunting-dogs, while their tents were very large and their camels were decorated in a way that suggested wealth.

To show that this region is not entirely without rain, I may record the fact that we came across several pools of rain-water caught and standing in hollow rocks. We should have passed them by unnoticed if it had not been for the camels, who sniffed the water from a considerable distance. This water would remain for several days if there was no wind, but with the least breeze it would soon dry up. There was a small encampment of Beduin near by, dependent on these small pools of rain-water for their drinking supply.

Along the edge of the Nafud I found a few more birds, and obtained samples of a chat (*Saxicola morio*), three larks (*Alæmon desertorum*, *Ammomanes desertorum*, and *A. cinctum*), and the cream-coloured courser (*Cursorius gallicus*). On the sand-dunes I found the broken eggs of the ostrich, and many small hares. An extremely venomous snake exists in this region, and I obtained one fine specimen. It is a horned viper of a bright sandy colour. But the most interesting fauna was the Arabian oryx, whose

haunts I had at last found. Here on the western edge of the sand-dunes they roamed in considerable numbers, and I carried off with me five entire skins of these antelope, which had not previously been hunted by Europeans, nor had they even been seen in their natural haunts.

Leaving the Nafud and turning west, I returned to the well of Hausa, passing on the way the borders of the smooth black plain of Bseita. This is identical with the Albuseita mentioned by Wallin in 1848. Although absolutely bare of all vegetation at the time of my visit, I noticed many little circular threshing-floors, where the Beduin prepare the seed called "semh," which grows in great quantity when there is any rain. The semh plant, according to the Arabs, cannot be reproduced from seed, neither have they ever succeeded in cultivating it. For this reason the Sherrarat call the plant "the gift of the rain." The grain is dried in the sun and ground into flour. This they make into bread, or mix with their dates, or eat as porridge.

The well of Hausa we found to be nearly dry, and, with thirsty camels and empty water-skins, we hurried on, travelling parallel with my out-going track, but on the west of it. This route took me to the wells of Bayer, in Wadi Bayer, where I chanced to fall in with a raiding party of Beduin. They were encamped at the well, on the look-out for Arabs coming in to get water. They at once took my party prisoners, and I should have lost all my possessions if the chief had not happened to be friendly with the tribe of the Beni Sakhr, under whose protection I had set out. I mention this as an example of Beduin chivalry, for the Arabs are still romantic highwaymen rather than bloodthirsty ruffians. They have not degenerated, neither are they illiterate or uncouth, but, on the contrary, exceedingly polite, and have the same powers of eloquence, and the same beauty of speech, which have always distinguished them. These desert-dwellers own no law but custom, and their custom is inviolable.

As a result of my capture by this raiding party, I made a most interesting discovery. The well called Bayer, where the robbers were encamped, is situated in the upper part of Wadi Bayer, some 55 miles east-north-east of the oasis of Maan. Now, this is on the line of the supposed ancient trade route between Egypt and Busra, and, as a proof of such a route having existed, I found at this very well the ruined remains of a large khan, or caravanserai. Such a building as this, far away out in the sterile desert, must denote an ancient prosperity which has long disappeared.

With the decay of Babylonia and the desiccation of Northern Arabia the trade routes naturally fell into disuse. Even the great trade centre of Petra is deserted, and Gerra, the terminus on the Persian gulf, is nothing but a name. Small wonder, then, that the wayside stations have fallen into oblivion.

This, then, is another link in the chain, and we now have an almost complete series of wells across the middle part of this route, namely, from Petra to Jauf. The stages between these two places are as follows:—

Petra to Maan, 20 miles.

Maan to Wokh, about 25 miles. This is a well and ruined village mentioned by Palgrave.

Wokh to Bayer, 30 miles.

Bayer to Weisit, 95 miles. (I should not be surprised if there is yet another well in this region, together with a ruined site, still undiscovered.)

Weisit to Jauf, 90 miles. This stage is through the Wadi Sirhan, where there are numerous wells.

Of the stage from Jauf to the head of the Persian gulf we know nothing, but on the old maps in the atlas of Ptolemæus, I find place-names at regular intervals, as if indicating the stopping-places on a caravan route.

These details will be of interest to those who propose a railway from Egypt to the Persian gulf. No greater hindrances exist than those already overcome by the builders of the Hejaz railway. As a whole the type of country would be easier than that crossed by the Mecca line, and the physical difficulties less severe.

The objection put forward that the Beduin would prove hostile to the building of the railway is, I think, unfounded. On the Hejaz railway this hostility does exist, it is true. It is partly the result of a weak government, but chiefly because the building of the railway takes away from the Beduins the blackmail which they have imposed from time immemorial on the pilgrim caravans, in return for a safe passage through their territory. Moreover, the trouble usually occurs on the threshold of the Holy provinces, and not on the northern deserts.

Now, if the "Suez-Busra" line was built, the Beduin who inhabit the region through which the line would pass, need not be interfered with in any such way. They would not lose their independence through the building of the railway. The Beduin are not unreasoning barbarians, but are quick to recognize a powerful and just government.

The Hejaz railway is not interfered with by the Beduin, except in the neighbourhood of the Holy provinces, and I have myself seen the strange sight of a band of marauding Beduin come in to a station on the line in order to get water for their wounded men and horses.

From the wells of Bayer, which, by the way, consisted of two well-pits about 40 feet deep, containing most excellent water, I travelled fast, until I reached the Hejaz railway at Khan Zebib, which is an old Saracenic castle on the pilgrim route. From here I made my way to

the tents of the Beni Sakhr, and thence by way of the Jordan valley to Damascus.

The PRESIDENT (before the paper): Mr. Douglas Carruthers, who has kindly undertaken to lecture to us to-night, has obviously many years' good work before him, though having already done some admirable scientific work. His first exploration of which I have any knowledge was that to Mount Ruwenzori, undertaken under the auspices of the British Museum. After that he went with Mr. Rickmer Rickmers to Turkestan, and we may hope to hear later on some of his experiences in those regions. Then he proceeded to Asia Minor, and he will to-night tell us something about his journeys in the lesser-known parts of Arabia. Subsequently he did some excellent work in the Dead sea region. He is, I understand, about to proceed on other journeys with some well-tried companions, and we may therefore look forward to a great deal more useful work coming from this explorer.

Mr. HOGARTH: If I must begin the discussion, I shall avail myself of the opportunity to congratulate Mr. Carruthers on having made an exceedingly interesting journey, and on having come safely back. I think you will all agree with me that he has spoken with rare sympathy and insight about that most interesting people, the nomadic people of Arabia. It is the people of romance *par excellence*, wandering for ever in the most God-forsaken country in the world. The Beduins on the west side of the delta have a story that the Creator actually forgot them in the creation. At the same time, as I think Mr. Carruthers has shown you, they are a very highly chivalrous people among whom it is not really difficult to travel if you observe their ways and keep the rules. Arabs appear to live by robbing one another, but that practice is carried on according to certain rules, which make it really very like playing a game—a great rough game like football, perhaps not even so rough as football after the American fashion. It is but rarely that many are killed at it, and I am glad to hear Mr. Carruthers bear his witness that the raider does not go out in the first instance to kill. There is one interesting feature of the game—that, in the case of battle near an encampment, it is a recognized thing that neither party enters the camp. The fight is carried on according to certain rules well away from the camp, and does not endanger the lives of the women and children, who are left behind to look after the camels.

Mr. Carruthers has been exceedingly modest about what he achieved, and it is of course true that he only got a very short way into Arabia; but he travelled over a road which has not been travelled before, so far as I know, and only one man (whom he mentioned), the Italian Guarmani, who was one time a consul in Jerusalem, has travelled over a tract of country near that which he took. Guarmani's account of his journey is extremely short and unsatisfactory, and, perhaps I might add, there has always been a certain doubt as to whether he took that journey at all. Mr. Doughty, at any rate, who has every reason to be heard with the deepest respect, has always refused to accept the fact of Guarmani's visit to Kheibar. I must congratulate the company on having been present to-night, when these photographs of one of the interior oases of Arabia have been put for the first time on the screen. They were very admirable photographs, and, indeed, I have not seen better of nomadic Beduins before. They seem to represent the life as really and as intimately as Mr. Carruthers' own account shows he had seen it. If he was not in any great danger in passing through the Beduin tribes, his dangers, as you see, began when he got into the first of the oases. That has always been the case in Arabia. It is perfectly true, as he said, that the oasis peoples are much more

fanatical, and, indeed, it is not difficult to understand. The Beduin knows perfectly well that nobody wants to take his land from him; but the oasis inhabitants are so rich, in comparison with the land about them, that they get an exaggerated idea of the value of what they possess, and they naturally expect that any traveller will be envious of them, and means to organize an expedition which will take their country from them. There is, of course, also the great fact of the slave-trade, which especially affects the oases dwellers. The latter are well enough acquainted with the outside world to know that the Western nations have set themselves against the trade on which they are dependent for their own well-being and life, and they naturally fear that any European will sooner or later subvert the basis of their existence. Teima is a very interesting place, which has retained its name from the most primitive antiquity which we know anything about, and has been made famous by the inscription now in the Louvre at Paris, which was found built into one of the lining walls of that great well of which Mr. Carruthers spoke. It has been visited, as Mr. Carruthers said, by more than one European, but Euting, who is now Professor at Strassburg, is perhaps the only other European who has been there. His companion, Huber, was murdered some time after he had been at Teima, but not, as perhaps Mr. Carruthers may have led you to suppose, as the result of his having visited that particular oasis, for he had got right down to the coast, and was about to start again into the interior of Arabia when he was murdered somewhere near the coast of the Red sea. I do not know that I need detain you more, except to express, in common with every one else who takes any interest in Arabia, the hope that this will not be the last journey Mr. Carruthers will attempt in that country. He must now be known to several of the most important people in the tribes of North-Western Arabia, and he will start on the second occasion with a very great advantage. Everything depends upon your being known and being passed on by one important person to another, and I hope that when things are a little quieter Mr. Carruthers will repeat his attempt.

Colonel MAUNSELL: I must congratulate Mr. Carruthers on a most interesting and instructive lecture. I cannot claim to have penetrated far into Arabia, still I have made a journey on the Mecca railway as far as Tebuk, and have been able to note some of the charms of the desert which he has described. The photographs naturally cannot convey all the brilliance of the desert scheme of colour, which is the great beauty of this part of what has been described as the "Garden of Allah." The general elevation is from 3000 to 4000 feet, and the air is extremely clear, dry, and bracing, so that long marches can be supported without fatigue.

The Batn-el-Ghrul station on the railway may be termed the "gate of Arabia Petræa," as it stands on the edge of a long depression which extends south for nearly 150 miles, the view being over a waste of hill and plain, reflecting the most brilliant colours, from the light yellow of the sand to the bright red and violet of the nearer hills and black and purple of the serrated ridges towards the Red sea coast. On the horizon possibly there will be a beautiful mirage clear-cut against the intense blue of the sky. I think we may deduce from this splendid desert air a considerable influence of climate upon the character of the Arab inhabitants; their thin wiry frame, nervous, high-strung disposition and imaginative temperament are direct consequences of living always in such air, and explains why the true Beduin pines away when removed to another climate and is shut up in a house.

As regards rivers in Arabia, there are of course none except broad dry wadis, which seldom contain water. The rainfall may be taken as triennial, and is usually very heavy for a short period. The water drains into large shallow depressions, one of which is near Tebuk, another near Jebel Itbaik on Mr. Carruthers' route, and a third the wide basin of the Wadi Sirhan. The underground river at Teima

is probably part of the considerable flow which moves underground in a mysterious manner towards the head of the Persian gulf, and is probably a tributary of the great Wadi Ermek, which joins the Shatt-el-Arab near Busra. The discovery of the ruined Khan on a route between Maan and Jauf is of great geographical interest, as it proves the existence of a communication on the shortest line between Egypt and Baghdad. Such a communication may well be restored by rail in the future.

I must again thank Mr. Carruthers for a most interesting lecture, and for a considerable addition to our knowledge of unknown Arabia.

Dr. STEIN: I have had the good fortune of spending some of the happiest time of my life in certain deserts, and I believe those who have shared such pleasures can understand why one cannot help feeling a deep interest in any other desert. Central Asia is a long way from Arabia, but I felt almost at home when some of those fine lantern-slides recalled to my mind scenes I had witnessed far away in the centre of Asia. When Mr. Carruthers spoke of the many weeks which he had spent travelling with the Arabs which afforded him protection, I confess I felt a sort of hearty envy. I believe that is the only way in which an extensive tract of country, offering such uniform features, can really be studied. I think, also, that the remarks which he made as regards the extent of vegetation, both along the sandy tracts of desert and among the dunes, will be appreciated by all those who have had problems of a similar kind to face in Central Asia. I have not been surprised at what he mentioned about the considerable amount of vegetation to be met with, even among the extensive tracts of dunes. We see the same, though on a smaller scale, in the Takla Makan; in fact, in most of the great sandy areas of Central Asia. I cannot go into the suggestions which might explain the occurrence of such vegetation; I believe it will be found that the formation of the ground is one of the chief factors which determine it. I was particularly struck by the great number of camels which these tribes are able to maintain in their wanderings. It is evident that Arabia receives great benefits from its vicinity to sea areas. It would be quite impossible anywhere in Central Asia to think even of hundreds of camels being taken about in this fashion by relatively large tribes; there would be neither water nor adequate grazing for them. I have not had the good fortune ever of travelling with a "fast train" of camels; it was my lot to pilot "goods trains" of camels through the desert, consequently I cannot claim such experience, as Mr. Carruthers no doubt gained, of the finer type of camel, but I can entirely support what his personal experience has shown as regards the length of time camels can work altogether without water. If in Arabia camels can be used for riding, without getting wasted, for seven or eight days without water, it is not much to be wondered at that those "goods trains" of camels in Chinese Turkestan can march along for more than two or three weeks, carrying heavy loads, without replenishing their water-supply. I have had myself the pleasant experience of taking such a "goods train" of camels for sixteen days through heavy dunes, and I am entirely convinced that the statements which are heard from men who have managed camel caravans, that their animals have maintained themselves for over three and four weeks during the winter, are correct. It is very largely, I believe, a question of the heat to which the animals are exposed. I can only conclude these remarks by an expression of my great pleasure in hearing of the interesting archæological discovery which Mr. Carruthers made towards the end of his journey. It was indeed a lucky raid which enabled him to find the old caravanserai along what evidently looks like a route from Egypt towards the Persian gulf. With regard to the remark that he made that this would be likely to indicate a better physical condition of the region, I must venture to make a historical observation. Where

human factors are concerned, we cannot entirely go without direct historical evidence. I have too often noticed that just at periods when apparently prosperity was low, yet such periods were marked by special measures for the protection of thoroughfares to facilitate progress. It is just at times when traffic is difficult that human ingenuity makes great efforts to overcome the difficulties of nature. I wish to express again my hearty admiration for the power of endurance which evidently enabled Mr. Carruthers to perform this long arduous journey.

Captain SLACK: The lecturer has referred to the Austrian dollar, the Maria Teresa. I should like to know something as to its value, which is, I think, about 3*s.* 6*d.*, but I should be glad to know whether that is so, and also where Mr. Carruthers changed his money to carry out his expedition. I believe the Maria Teresa dollar is used down the Red sea, and also as far as Zanzibar. He might also tell us whether there is any idea of carrying the railway down south. I think he also said that there were not so many secrets now to be extracted from Arabia, but I hope he will do us the pleasure of affording some of his experiences in further expeditions he may take in that direction. I think there are a very great many secrets to be extracted from Arabia, and very little is known of its southern interior.

The PRESIDENT: I also want to ask the lecturer one question before proposing the vote of thanks to him. I notice that he speaks of the sand-dunes beginning quite suddenly—that you could almost step from the desert land on to the sand-dunes. The other day we had a very interesting paper from Mr. Beadnell on the sand-dunes of the Libyan desert, who mentioned the same thing, and described how sand remains drawn together in as it were long strips stretching for miles across the country. Has Mr. Carruthers ever considered what makes the sand remain in distinct patches, or why in some valleys it looks almost like water, its edges are so well defined? I venture to suggest the following explanation as possible. The sand, either because it contains air in its interstices, or possibly because of its physical conditions, may hold the heat better than the surrounding desert. Now, if this be so, during the night there will be an up-rush of air from the sand-dunes and an in-rush from the desert, and the result will be that any loose particles of sand on the desert will be as it were swept on to the sand-dunes, and a tidy edge will thus be given to this formation. I hope Mr. Carruthers, when he again visits such regions, will take the trouble to measure the temperature during the night-time of the sand-dunes, and of the desert near it, in order to see if this theory is likely to be correct. In conclusion, in your name I have to thank Mr. Carruthers for the very interesting and valuable description of this wild region.

Mr. CARRUTHERS: As to the rate of exchange of the Maria Teresa dollar, I cannot remember off-hand exactly what it was, but they are to be procured in Damascus only through the Arabian merchants. You cannot buy them up in the deserts, nor exchange them at the ordinary moneychangers. I obtained mine privately. The dollar, by the way, is used all over Arabia, not only on the Red sea-ports, it is current all over Central Arabia. The natives won't take Turkish money of any kind except the gold lira. As to the railway extension, I do not think it will be carried much further than Medina for some time. The tribes between Medina and Mecca will not allow it at all. I think Major Darwin's explanation of the distribution of the sand very sound indeed, and I hope the next time I go I shall be able, perhaps, to find out a better explanation.

NOTES ON KORDOFAN PROVINCE.*

By Captain WATKISS LLOYD, The Cameronians (Scottish Rifles), Late Governor of Kordofan.

In 1899, when the Khalifa was killed at Um Debreikat, our knowledge of the country between the Nile and Darfur was extremely limited. The best available maps were War Office map I.D. 332 and the French staff map of Africa, the latter being the more complete, as the routes of all known travellers were shown. Though many of these routes were very inaccurate, they were extremely useful. The western, south-western, and most of the southern portions of the province were shown as blank and quite unexplored. Several travellers had described the eastern and northern districts fully and accurately, but the ravages of the Dervishes had destroyed all the villages, and where former travellers described miles of waving fields of corn we found nothing but bush. One of the most accurate observers was Ignatius Pallme,† much of whose work might have been written yesterday. His description of a raid by the troops in 1838 goes far to explain the difficulties we have often had with the Nubas.

In December, 1899, Colonel B. Mahon, C.B., was appointed Governor, and reoccupied the province, and from that time the work of exploring and mapping the country has gone on until there are now no considerable blanks left on the map. The route-sketches were generally made with a prismatic compass, the distances being timed, but some triangulation has been commenced, and a number of observations for latitude have been taken all over the province. In 1902 I compiled the work that had been done on a scale of 1 : 500,000, and it was printed for local use (I.D.W.O. 1629 and 1630). The result was, of course, too inaccurate to publish, but it gave a general idea of the country. Soon afterwards a few sheets were published on a scale of 1 : 250,000. Captain H. D. Pearson, R.E., Director of Surveys, has now compiled the greater portion of the province map on a scale of 1: 250,000, and a map on a scale of 1 : 1,000,000 is in course of publication. This, though not accurate from a strictly cartographical point of view, gives a good idea of the country, and will be of the greatest value for military and administrative purposes. Nearly every one is convinced of the necessity of such a map being based on a triangulation, but in a poor country, where the Survey staff is limited, it is only possible to make use of the best means available, and with care and practice it is extraordinary what good results can be obtained with time-sketches

---

* Map, p. 356.

† There is a German copy in the Society's Library, and an English translation in the London Library.

checked by a few observations for latitude. Keeping the maps and route-reports up to date involves much work, as not only are new villages constantly being built, but old ones are often moved several miles to fresh ground, and in some parts of the country the system of naming villages after the sheikh leads to changes of name whenever a sheikh dies.

As at present constituted, the province of Kordofan consists of some 130,000 square miles, and has a population estimated roughly at half a million. The name, which dates from the time of Mohammed Ali Pasha, is really a misnomer, as the Arabs only know the country round El Obeid and Jebel Kordofan as Kordofan, each portion of the province being named according to the tribe that inhabits it, as Dar Homr, Dar Nuba, etc., that is, the country of the Homrs, or the country of the Nubas. The whole province is about 400 miles from north to south and 350 miles from east to west, and falls naturally into two divisions, the dividing line running obliquely from lat. 12° N. on the Darfur frontier to lat. 13° N. on the White Nile.

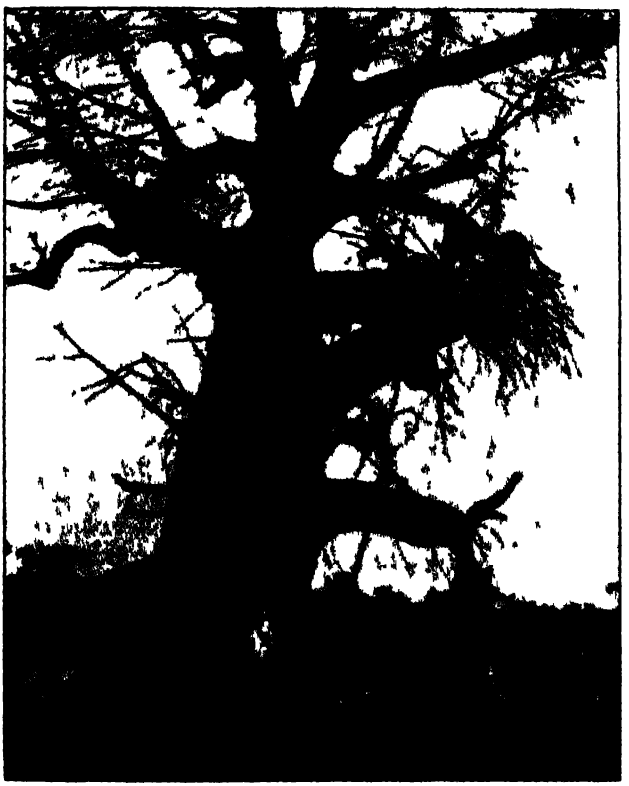
We will consider the northern portion first. It consists of a plain broken in the north by clusters of granite hills which rarely exceed 600 feet above the plain. The plains are generally sandy, and have been formed by the destruction of granite and sandstone hills by the action of heat and wind, but north of lat. 14° 30′ N. they are often stony and broken by many wadis (watercourses or valleys) which run down from the hills, and either lose themselves in the sand or, striking a rocky ridge, form a small lake, which quickly dries up after the rains cease. The salt left behind is often worked by the natives. These plains are either bare or covered with low bush, which becomes thicker and more dense in the wadís.

About lat. 14° 30′ N. the real bush commences, and the country becomes more undulating. There is no visible watershed, and the rain sinks in where it falls, though in a few places it collects in ponds (called fulas) which hold water for a few weeks after the rains cease. This district extends as far south as the line between northern and southern Kordofan, and in it are found most of the gum forests which constitute the chief wealth of the province.

Along the river there is a belt of low ground, chiefly black soil, which is in places 12 miles wide, but often much less. This ground, which is very fertile, is broken by many watercourses, and much of it is liable to floods at high Nile. Politically it belongs to the White Nile province. Westwards of this low-lying belt the country rises rapidly, the soil becoming much more sandy when the river-valley is left and El Akaba, a waterless and almost treeless district reached. This extends from Id el Ud and Zereiga on the east to Hashaba and Jebel Kon on the west, and is uninhabited except during the rains, when the riverain population drive their flocks into it, as the grass

which then springs up affords excellent pasture. In the dry season it is a shadeless and barren waste.

West of El Akaba the country is undulating, the hills becoming higher and steeper towards the west, until within 10 miles of El Obeid, an almost level plain is entered. Towards the valley of the Khor Abu Habl the undulations develop into well-defined ridges having their general direction north and south. West and north-west of Bara the sandhills become very steep and soft, and enclose a number of small



BAOBAB TREE USED FOR STORAGE OF WATER. THE MAN ON THE BRANCH IS GETTING WATER OUT OF THE TREE.

basins At the bottom of each basin, locally called a "khor," the soil is white sandy earth containing some lime. Water is found at a depth of from 4 to 10 feet. As the soil is fertile and water-wheels can be used, this district, which is known as El Kheiran (*i.e.* the Khors), was formerly very highly cultivated. It extends from Ashaf in the south to Shershar in the north, and was devastated by the Dervishes when retreating westwards after the battle of Omdurman, but is now recovering rapidly.

The plain round El Obeid is comparatively level, and the soil much less sandy than in most parts of northern Kordofan. Except in El Obeid, where there are many excellent wells, water is scarce. The soil is, however, fertile, and there are many villages. Thirty miles west of El Obeid, Dar Hamar commences and extends to the Darfur frontier, a distance of about 170 miles. It consists of sandy steppes covered with bush where it has not been cleared for cultivation. The country is quite devoid of watercourses except in the vicinity of the northern hills, but there are several large valleys, which are generally full of baobab trees (*Adansonia digitata*) and are locally called "shegs," viz. Sheg el Dud* and Sheg el Hafiza. The hills in the north are nearly all granite, though there are a few of sandstone, such as Jebel Beraish near Foga and Jebel Wad Heidub near Nahud.

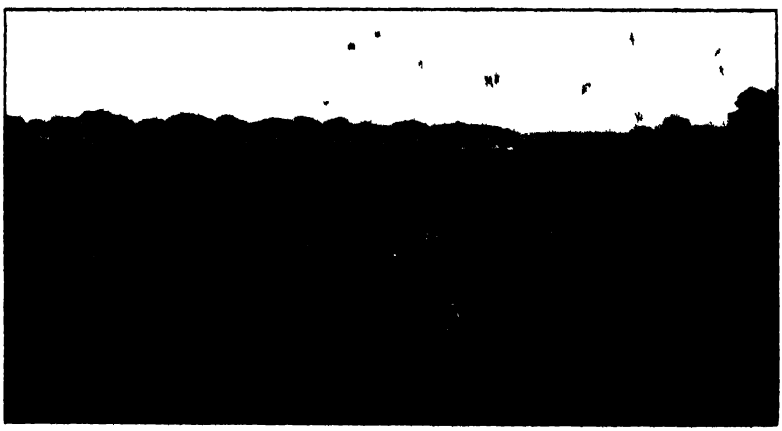
Water is the most absorbing topic of conversation in Northern Kordofan. North of lat. 14° N. the numerous watercourses contain much surface water during the rains, and in good years for two months afterwards. When the surface water dries up, wells are dug and deepened from time to time until the water gives out. There are, however, several places like Safia, and Bagaria in the Wadi el Malik, where a good supply of water can always be obtained. It is quite a mistake to regard the country west of Khartum as a waterless district. Now that the people have returned and opened the wells, it is, even in the dry season, very exceptional to go 100 miles without finding water, though there is not enough to support a large sedentary population.

In the country between El Akaba and the river there is plenty of water all the year round. Between El Akaba and El Obeid the wells are numerous, and water is found nearly everywhere but in ever-varying quantities, the wells being supplied from a small area and dependent on the local rainfall. The best are generally in the sandy hills, which hold the water better than the low-lying and more clayey country. The best wells are in El Kheiran, where water is found a few feet below the surface, elsewhere wells are often 100 feet and sometimes nearly 200 feet deep. They are of two kinds. The first, as at El Obeid and in parts of Dar Hamid, are cut through firm soil and not lined. These last for years and require little care. The second kind, which are far more numerous, are dug through the sand. They are seldom more than 4 feet in diameter, and as the sand is dug out, have to be lined with grass rope, which is put in in lengths of 30 or 40 feet until the water-level is reached, when the roots of trees are used as standing the water better. These wells seldom last more than two or three years, when they fall in. As it is easier to dig a new well than to repair an old one, the fact that the remains of many old wells are

* Marked on old maps as Cheguedou.

found at a village does not indicate that more than one or two were ever open at one time. West of El Obeid in Dar Hamar there are practically no wells except at El Odaiya and Nahud, the water at Foga, which was formerly the great Hamar watering-place and the site of a Mudiria, having completely given out.* Elsewhere the people are dependant on water-melons and the water they store in baobab trees. The melons are small and almost tasteless, and are grown in enormous quantities amongst the corn. When ripe they are collected in heaps and protected from the sun until required for use.

The baobab trees have to be carefully prepared for use as reservoirs. The large branches are first cut off near the trunk. If this is not done, the trunk is apt to split as soon as it is hollowed out. A hole is cut in the trunk, generally just above a branch, which serves as a platform



THE BAHR EL HOMR AT FAGOI, CAMEL CORPS WATERING.

for the man who is filling the tree, and the interior is hollowed out. Round the bottom of the tree a shallow basin some 20 or 30 feet in diameter is made, in which the rain-water collects. As soon as there is a storm, the people go out and fill their trees. The water so stored remains perfectly good until the end of the next hot weather, or even longer. A few trees, naturally hollow, have a hole at the top between the branches, and fill themselves, the branches catching the water and acting as gutters. These are called "lagai," and are highly valued by the Hamars.

* The cause of the water giving out has not yet been satisfactorily explained. The same thing has occurred at other places, such as Melbis, which was formerly the garden of El Obeid. At Abu Haraz water-wheels were formerly used, but the water, though sufficient, is now much too far down to make their use possible. On the other hand, at El Obeid and some other places, water is now found nearer the surface than it was twenty years ago.

The Arabs did not invent this method of storing water, but improved on the system of their predecessors, who made the hole in the trunk only 10 or 12 feet from the ground. The present system gives a cistern 20 feet high and from 8 to 10 feet, or even more, in diameter. Owing to the labour involved in preparing and filling the trees, water is usually bought and sold, and on the main roads where there is much traffic, as between Nahud and Jebel el Hilla on the way to El Fasher, the capital of Darfur, the people do a regular trade by supplying merchants and travellers with water.

The bucket, called a "dilwa," used by the Arabs deserves mention. It consists of a piece of leather suspended by strings 6 inches long from a piece of wood bent in a circle, to which the rope used for drawing the water is fastened by three or four strings. On reaching the bottom of the well the leather opens out and collects the water, however little there may be.

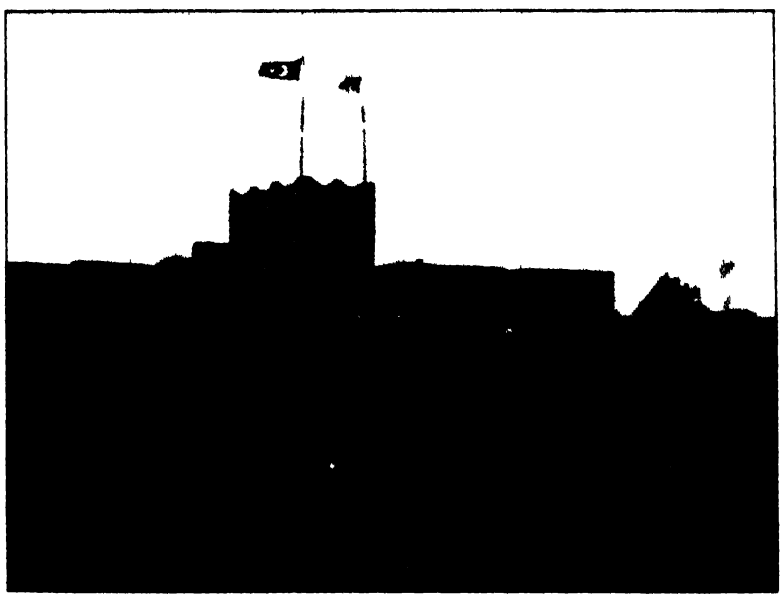
Along the southern edge of the Gawama country, where the sand-hills end and the black soil of Southern Kordofan commences, there are three small lakes, El Birka, Rahad, and Sherkeila. El Birka is generally dry by December, but the two last hold water till the end of January, and sometimes for the whole year. When they are dry, wells are dug in the beds of the lakes and give a good supply of water. It is doubtful if any of these lakes connect with the Khor Abu Habl at any time, but it is possible they do when they get exceptionally full and overflow.

To turn to Southern Kordofan, which is the home of the Baggara or cattle-owning Arabs and the Nubas. Here we find a totally different country, consisting of a plain of black soil, from the middle of which the rugged granite hills of Dar Nuba rise to a height of 3000 feet. Instead of the rain sinking in where it falls, as in the north, the country is drained by several considerable watercourses, which carry much water during the rains, though all are dry a few weeks after the last storms.

The country between the White Nile and Dar Nuba is covered with thick bush and cut up by khors or watercourses, many of which flow northwards to the Khor Abu Habl. Along the river there is much swampy ground, and numerous channels parallel with the river make landing a matter of some difficulty at all seasons, and quite impossible at high Nile except at the recognized "meshras," or landing-places. The soil, which becomes wet and heavy during the rains, is full of shrinkage-cracks in the dry season, so that travelling is always troublesome work.

Dar Nuba occupies an area about 150 miles square. The hills rise abruptly from the plain with but little system, sometimes in large masses like Tagali and Miri, but often as isolated hills, but the general trend of the main valleys is north and south. The hills differ much

in their formation. Some, like Nyema and Fanda, consist of masses of huge granite boulders containing many caves and hiding-places which are used by the Nubas in time of war. On many of these hills there are passages behind the rocks which enable the inhabitants to move about without exposing themselves. These passages are partly natural, but have been improved by the natives. The interior of such hills is full of narrow valleys, which can only be reached by steep and difficult paths. The inhabitants often successfully resisted the Dervish raiding parties, and when we first reoccupied the country they believed their hills to be impregnable, and were apt to give trouble by raiding their weaker neighbours. Other hills, such as Ghulfan, are less rocky, and



OLD GOVERNMENT BUILDINGS AT EL OBEID, 1900.

have earth up to the top. These were sometimes completely depopulated by the Dervishes, and even now a few remain uninhabited.

West of Dar Nuba the plain extends to beyond the Darfur frontier. Except where cleared for cultivation, it is covered with bush, which gradually changes into forest towards the south, as the valley of the Bahr el Homr is reached. South of Dar Nuba the plain consists of black soil overlying the sponge-like ironstone characteristic of much of the basin of the Bahr el Ghazal. The bush extends to within 20 miles of the river, beyond which is a treeless tract of black soil which in the rains becomes a swamp, and is covered with high grass, while in the dry season it is full of shrinkage-cracks and the grass gets

burnt. This sort of country, which is also found in parts of Dar Homr, is called "fau" by the Arabs, and travelling across it is exceedingly laborious at all times of year.

The drainage system of Southern Kordofan is simple. The Khor Abu Habl rises in the hills west of Dilling, and flows north-east to Sungikai, where it turns east, finally losing itself in the sand-hills near Gedid. During its eastern course it is joined by many affluents from the south, most of which rise in the Nuba hills. There are many good wells along its course.

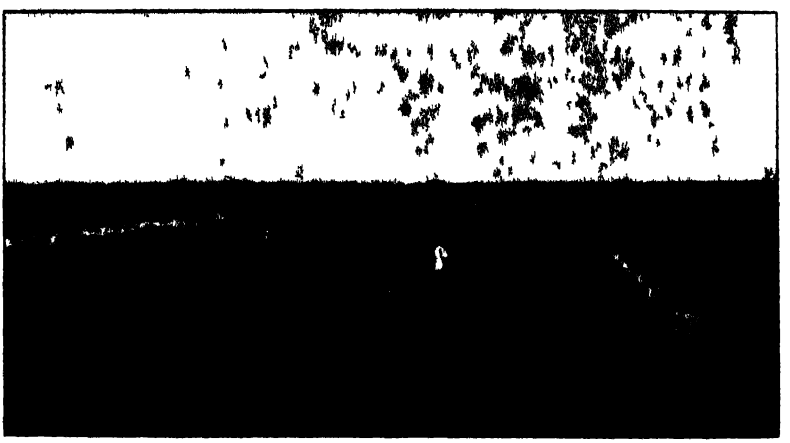
Commencing as a "sheg" in Dar Hamar, the Wadi el Ghalla flows south-west past Abu Zabbad and Muglad, and enters Darfur about lat. 10° N., and according to native accounts, which I have every reason to believe, loses itself in the plains a few miles beyond the frontier. On reaching the black soil near Abu Zabbad, the valley widens and the bed is full of grass and large "sunt" trees (a kind of acacia). At times it holds much water, though there is never any stream. Along the high ground on both banks there are hundreds of Arab camps and villages, with much cultivation (hence the name, Ghalla, meaning bread). As soon as the surface water dries up wells are opened in the bed of the wadi, which provide water for thousands of cattle until the following rains. To prevent these wells washing in, the mouths are often built up to a height of 8 or 10 feet above the ground. Its valley is far the best-watered district in the province outside Dar Nuba. The third important watercourse is the Wadi el Azrak, or Khor Shalango, which flows southwards along the western edge of Dar Nuba, being fed by many streams rising in the hills. It flows in a narrow but deep channel through a level valley, and often carries much water, overflowing its banks in many places for a considerable distance, though it runs dry very soon after the last rains, and in the dry season the watering-places in its bed are very few compared with the Wadi el Ghalla. It finally loses itself in the swamps near Turda.

Many of the khors from the southern hills run into Lake Keilak or Lake Abiad, neither of which has any known outlet. The former always contains water, and is about 6 miles long by 2 broad after the rains. It contains two kinds of fish, which are caught in large numbers by the natives. El Abiad is a much smaller lake, and only fills occasionally.

In addition to the wells in the khors, nearly all the Nuba hills contain good springs, and on many running water is found until the beginning of the hot weather. The worst-watered part of the country in the hot weather is Dar Homr, north of the Bahr el Homr, and the uninhabited country south of Jebel Eliri.

In the south, about lat. 10° N., is the Bahr el Homr, a river which, according to Sheikh Ali Gulla, the Nazir of the Homrs Ageira, rises

some 30 miles beyond the frontier. Following its course from the frontier to Hassoba, I found its actual bed was usually 100 yards wide, with steep, well-defined banks 10 or 15 feet high, but it contains much grass, and its lower reaches are completely blocked. It eventually joins the Bahr el Ghazal, but its actual point of junction is disputed. When it runs dry, about the end of January, the Homrs come south from Muglad and dig wells in the bed, which provide them with water until the next rains. Thirty miles further south, flowing nearly parallel with the Bahr el Homr, is the Bahr el Arab, the large river which rises beyond Hofrat el Nahas and flows eastward to the Bahr el Ghazal. It contains much open water, but its lower reaches are at present blocked with sudd. Lieut. Huntly-Walsh, R.N., who has explored much of its



STREET IN EL OBEID, 1908

course, believes it would be possible to clear it. A very small portion of this river is in Kordofan, nor does it drain any considerable area of the province.

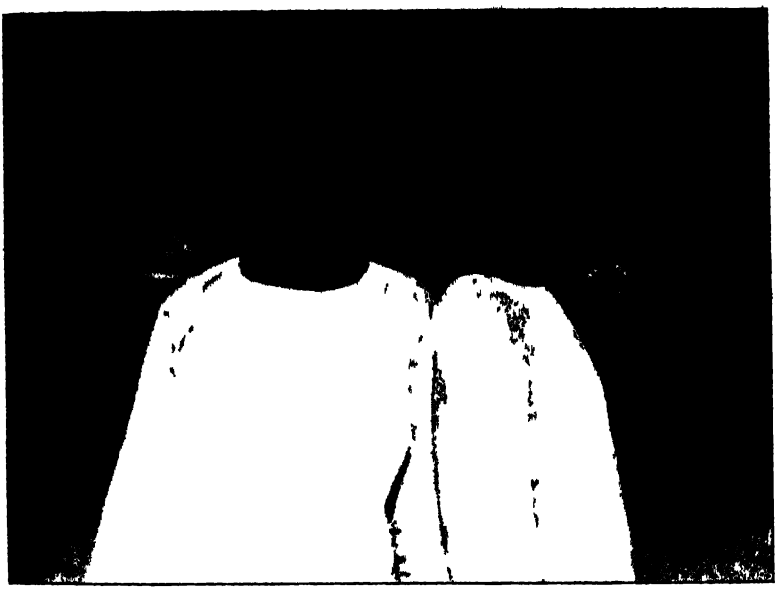
In such a large district the variations of climate are necessarily considerable. In the south the rains commence earlier, often about the middle of March, and end later than in the north. About the latitude of El Obeid the climate is good from November to March inclusive. Then the heat becomes oppressive, until the wind turns to the south about the end of April and brings the first rains. The wet season continues until about the middle of October, when the wind goes round to the north. Observations are taken at El Obeid, and show that the rainfall seldom exceeds 25 inches, July being the wettest month. In the south the rains are much heavier and last longer, and in the west, owing to the absence of hills in Dar Homr, the rains generally reach further north than in the eastern districts.

The province cannot be regarded as a health resort, though the accounts of most former travellers were much exaggerated. Malaria is the chief cause of sickness, and is prevalent all over the province, being worst just after the rains. Mosquito brigades have, however, done much to improve matters at the Government posts during the last few years. The Arabs very quickly grasped the fact that mosquitoes carried malaria, but the blacks and low-class Europeans were often troublesome to deal with. Among the natives consumption is rare, and cholera, scarlet fever, and enteric seem unknown. Leprosy is very common among the Eliri blacks, and elephantiasis is found in most parts of Dar Nuba. It is now some years since there was an outbreak of small-pox, but the Arabs are afraid of it and always value vaccination. Guinea worm occurs all over the province, but is most common in the southern districts.

Kordofan never formed an independent sultanate like Wadai, Darfur, or Senaar, but seems to have been in the hands of the last in very early times. In 1784 it was conquered by the Furs, who held it until 1820, when Ahmed el Defterdar defeated the Fur governor near Bara and conquered the country for Mohammed Ali Pasha. There seems no doubt that the original inhabitants were Nubas, or people of a kindred race, who were driven from the plains into the Nuba hills, and almost exterminated in the northern hills by the successive incursions of Fungs, Furs, and Arabs. The few people of non-Arab descent left in the northern hills are much mixed with Arab blood, and have quite lost their own language. These hills are covered with ruined villages, which the Kababish say they destroyed in recent times.

The present population consists of Arabs and Nubas, the latter being confined to the hills in southern Kordofan. The Arabs are divided into camel-owners, sedentary tribes, and Baggara or cattle-owners. The chief camel-owning tribes are the Kababish and Kawahla, but the Shenabla and Beni Garar own considerable herds. During the rains they drive their herds to beyond the Wadi Melh, the great wadi which, rising near Foga, extends northwards to the Nile near Korti. As the grass and water dry up they move south and east, until the Kababish are round Safia and Kagmar, the Kawahla in Dar Hamid and near Shegig, and the other smaller tribes among the Gawama villages and east of El Akaba. In addition to their camels, they own large herds of sheep and goats and a few horses. The great majority live in tents made of wool, and have no cultivation, living on their camels' milk and grain which they buy from settled tribes; but some of the sub-tribes have a little cultivation, and keep their sheep and goats near their permanent villages, which are all near Dueim. A nomad, however, always looks down on a cultivator, and some of the smaller tribes like the Maalia and Maagala, who lost all their herds during the Khalifa's rule, look forward to the time when they will be able to become nomads again.

The sedentary tribes occupy the country between lat. 14° N. and lat. 12° N. Between the river and El Akaba the most important are the Husseinat and the Hassania. West of El Akaba is the Gawama tribe, who own all the best gum-forests and are the richest of these tribes. To the north of their country is Dar Hamid, occupied by many small tribes of mixed origin, including the Ferahna, who are said to be descended from ancient Egyptian merchants. The Baghada, a small tribe living near Homra, claim to have come originally from Baghdad. Round El Obeid the Bederia and Shweihat are the chief tribes. They own considerable flocks and herds and much cultivation. Westwards from El Obeid, and extending to the Darfur frontier, is the



NUBA TYPES.

country of the Hamars, the largest tribe in the province. They have always been divided into two sections, the Asakara and the Degagin, under separate nazirs. Since the reoccupation of the country a portion of the latter section, the Ghereisia, have formed a new section under a nazir of their own. They formerly owned thousands of camels, but their herds were nearly all destroyed during the Dervish rule. Purdy says he saw some 30,000 camels watering at Foga in 1875. Owing to the absence of wells in their country, they have very few sheep or goats and practically no cattle. They have much cultivation, and usually have a large surplus of corn, which they make into merissa, or native beer. This is consumed in large quantities, and

drunkenness is exceedingly common among them. They also own large gum-forests, but at present the cost of transport prevents these being worked profitably. It may be possible to use them when the railway reaches El Obeid.

These tribes all live in villages, which vary much in size, but as a rule seldom contain more than sixty families. In Dar Hamar the size of the villages depends on the number of baobab trees available within a convenient distance. The huts are of the usual African conical shape, and the form built by the different tribes differ very little. As a rule, the workmanship is inferior to that seen among the Nubas.

The only large towns are El Obeid and Nahud. El Obeid, the capital of the province, has a fluctuating population, which reaches a maximum of about 12,000 in the dry season, when there is no water in the surrounding villages. The native town consists chiefly of straw huts, though the markets and many of the merchants' houses and shops are built of sun-dried brick. The chief trade is in grain, cattle, cottons, and gum. The barracks and Government buildings are at the south end of the town, and separated from the native quarter by a parade ground 500 yards wide. The town is built on the sides of a shallow valley, in the middle of which there are numerous excellent wells. Nahud (in Dar Hamar) contains some 10,000 inhabitants. It is the terminus of the telegraph line, and has a large market, the chief trade being with Darfur, where cottons and trade goods are sent in return for cattle and ivory. The town is built round a hollow, which contains the wells. In 1900 it was the only town in the province, El Obeid having been utterly destroyed. It then contained some 5000 inhabitants. Both towns have now been laid out with straight wide streets, and have an elementary local administration.

Practically all the Arabs in southern Kordofan belong to Baggara, or cattle-owning tribes. The Selim and Walad Hameid occupy the country between the Nile and Dar Nuba, and the Habbania live near Sherkeila. These tribes are small, and not very well off. The Howazama, a large and fairly rich tribe, occupy the greater part of Dar Nuba in the dry season. During the rains their chief camps are on the pools (*fulas*) between Sungikai and El Obeid. They are a large tribe, and are now very well off, having not only large herds of cattle, but many sheep, goats, and horses, and a considerable area under cultivation, though they do not grow enough grain to supply their wants, and have to purchase the remainder from the Nubas. The Messeria, a small but rich tribe, occupy a number of villages on the upper part of the Wadi el Ghalla during the rains, and in addition to large flocks and herds, have much cultivation, and bring large quantities of grain for sale into the markets at El Obeid and Nahud. During the dry season they go to various watering-places in the western Nuba hills, ranging as far south as Jebel Dago and Jebel Abu Likri. The country between Dar

Nuba and the Darfur frontier belongs to the Homrs, whose country I described in the *Journal* on a former occasion.*

The Baggara have a bad name on account of their cruelties under the Khalifa, and they would no doubt raid on every possible opportunity if they dared. At the same time, they are the most enterprising people in the province, and many of the poorer men go down to the river and work on the public works in Khartum until they can save enough



NUBAS. THE MAN ON THE RIGHT IS THE KUGUR DALDUN OF J. FANDA.

money to buy some cattle and settle down in their own country. Petty crime is practically unknown among them, and their internal quarrels are nearly always due to the efforts of some sub-tribe to increase its wealth or position in the country. Like all nomads, they are extremely independent, and tribal organization is only kept up by the distrust the tribes feel for one another, though a sheikh, once he has been accepted by the tribe, is usually obeyed loyally as long as he is a just man and settles tribal matters fairly. It is always impossible for a European

* See *Geographical Journal* for June, 1907.

to fathom the mind of an Oriental, but a Baggara Arab can generally be trusted to speak clearly and fully if he thinks he has a grievance, provided he knows the official he has to deal with.

The Nubas, who now all live on the hills, know little of their early history, and their legends are few and hazy. They say they formerly occupied the country as far north as Halfa, and when one remembers the countless thousands of slaves who must have been taken out of the country since early Egyptian times, this seems quite possible. They were undoubtedly driven south by the Arab invasion of the Nile valley, and no doubt suffered from the various Fung invasions, being finally driven out of the plains when the Baggara tribes came from the west. The way in which Nubas speaking different languages * are mixed up, adjacent hills being often unable to understand one another, points to the remnants of the tribes from the north and west having fled to the hills and settled on any unoccupied ones they could find. Some may not have been hill tribes originally. The people of Jebel Dago, Shat el Safia, and Shat el Damman speak the same language. The natives of the two last hills say they formerly occupied the whole of Dar Homr, and this is confirmed by the Homr Arabs, who say there is still a small settlement of the same tribe at a place they call Shat, a few miles over our border. Whether they are related to the large Dago tribe in Darfur, mentioned by Slatin Pasha, I cannot say.

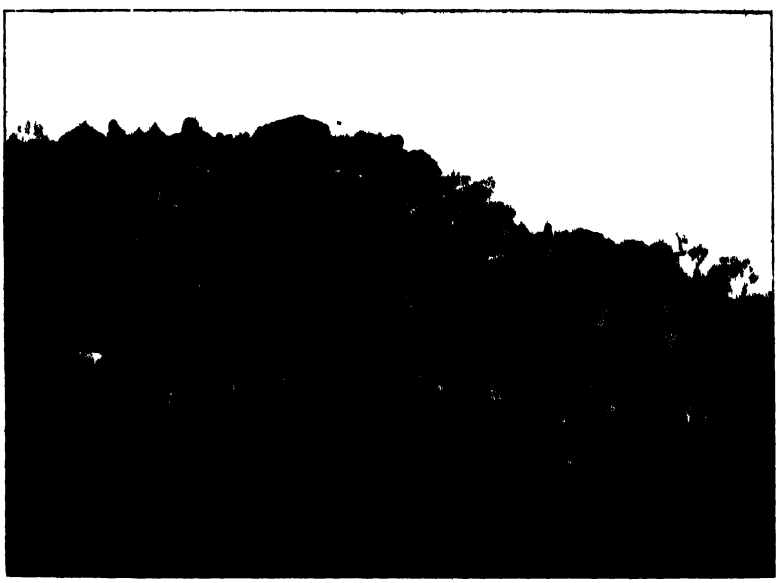
In southern Kordofan the Nubas seem to have been left alone until the arrival of the Baggara Arabs, who divided the country among themselves and raided the Nubas for cattle and slaves. When Mohammed Ali Pasha took over the country, no attempt was made to administer the southern districts; but tribute was taken, often in the form of slaves, from the Arabs and more accessible hills. To collect the tribute troops were sometimes necessary, and Pallme gives an interesting account of such an expedition against Jebel Daier. Under the Dervish rule, the Emirs sent to attack the Nubas reduced the more exposed hills, and in some cases carried off almost the whole population, but many of the larger hills, such as Nyima, resisted their attacks to the end, though they lost very heavily. As a result of their treatment in the past when we reoccupied the country, though the Nubas were very pleased to welcome the troops who had defeated the Khalifa, they were not prepared to trust us very far. They are, however, gradually settling down, though still not above raiding one another from time to time.

Many of the hills, such as Tagali and Tagoi, are Moslem, but the majority have a religion of their own, which among the northern hills is well defined, becoming more indefinite towards the south, until at Talodi no trace of religious ideas can be found. All the Moslem and

* Eleven languages are known to exist, viz. Dilling, Katla, Koalib, Keiga, Moro, Tagali, Dago, Misakin, Kadugli, Krongo, and Nyema.

most of the other hills are ruled by a mek, or hereditary headman, who is controlled by a council of elders. In the rest, the kugur, or head priest, whose power is almost absolute, rules the people, though in a few hills there is both a mek and a kugur, the latter being generally the more powerful.

The Nubas are not idolaters, but believe in one Supreme God who rules the world through spirits (called Arro) appointed from the dead ancestors of each hill. In the next world each hill has its own appointed place, to which the inhabitants go at their death. The kugurs act as mediators between the Arro and the people, and are credited with power to bring every sort of misfortune on the people if they like. Their influence is, therefore, enormous. As they receive a share of all



NUBA VILLAGE.

crops, cattle, and of all loot taken in war, they are generally well off and always difficult to deal with. When a kugur dies, the people wait until one of their number declares the "Arro" has entered into him. He then makes a prophecy of some sort, and if it comes true he is proclaimed kugur. By this means of selection the kugur is generally the most astute man in the district. Occasionally a woman is chosen, there is one at Farla. Being opposed to any stronger outside influence, the kugurs are generally against Government interference, but their mutual jealousies make any combination among them unlikely.

Nuba fights and quarrels generally begin with some young man who wants to get married raiding for cattle. One or more people get killed, and a vendetta is started which goes on in a casual way for

years. The attack on a village is never pressed home, and usually leads to but little loss of life. Against the Arab slave-raiders the Nuba was always on the defensive, and fought with desperate courage. The northern hills are well provided with Remington rifles, which they either took from the Dervishes or purchased from the Arabs, who formerly relied more on their horses and spears than on firearms, and were glad to exchange rifles for cattle. Now they would give anything to get the rifles back. Ammunition is manufactured locally. The old cases are filled with powder made locally, the caps being made with matches covered with lead-paper. The men who have no rifles are armed with clubs, spears, and shields, and all carry a long knife. The clubs are of the knobkerry type, sometimes furnished with stone heads. Shields vary much in shape, and are made of leather. Most of the spears have iron heads, either made locally or bought from the Arabs, but in some of the more remote hills spear-heads of hard wood or bone are still used.

In character the Nuba is brave, very conceited, and intensely suspicious. According to his own lights, he is industrious, as he clears large areas for cultivation. When not cultivating, that is for seven or eight months in the year, he sits on his hill and looks at the view, or does a little raiding. He has, however, considerable manual dexterity. He builds excellent huts, and shows much skill in making his household utensils, though the true Nuba makes no kind of cloth. On most hills both sexes go almost naked, and on a few, such as Fanda, they are absolutely so. The women ornament themselves with scars cut in elaborate patterns, and on some hills stain themselves with reddish earth. Those that are better off wear brass or iron bracelets and earrings, and the women often have elaborate girdles of beads, and a strip of cloth worn between the legs and hanging down to the ground in front and behind. Near Government stations Manchester cottons are coming into use—a doubtful advantage, as the Nuba never washes, and his villages are indescribably filthy. Many villages now own considerable herds of cattle, and all have numerous sheep and goats of a small and active breed, they also keep a small breed of pig, the flesh of which is much valued; the less said about its habits the better.

Physically the tribes differ a good deal, the northern tribes being generally smaller and of lighter build than the southern ones. In colour the majority are a reddish-black, that is, lighter than the Dinkas and darker than the Niam-Niam.

Round the base of some of the southern hills, such as Eliri and Talodi, there are settlements of escaped slaves, who revolted and ran away from the Howazama and Homrs many years ago. They are a low type of black, extremely dirty and lazy, and suffer much from leprosy. They speak Arabic, and call themselves Arabs, though really

a mixture of many black tribes. Each sub-tribe retains the name of the Arab tribe it formerly belonged to.

The resources of the province are considerable, but require time and population to develop them. All the main roads have been cleared of bush, and a railway is to be built from the river near Kosti to El Obeid, but at present all transport is by camels in the north and pack-bulls or donkeys in the south. The chief source of revenue is gum arabic. Only the forests near El Obeid and between El Obeid and the river are worked; but with the arrival of the railway, it will no doubt pay to work the forests in Dar Hamar, which are of vast extent. The best gum comes from the grey acacia, called hashab.



IRON-SMELTING FURNACE AT NAHUD.

This is found chiefly between lats. 13° and 14°. The method of cultivation is simple. In December or January strips of bark half an inch wide are torn off the tree, and any dead branches cut away. As the hot weather comes on the sap runs up the tree and oozes from the wound. The gum is collected about every ten days, until the rains commence. Gum is also collected from uncultivated trees, but is worth little. South of the Khor Abu Habl there are large forests of red gum trees (talh), but they are of comparatively little value and seldom worked.

The chief grains grown are dukhn (*Pencilaria spicata*) in the north and dura in the south. The latter requires more rain and better soil than dukhn. Both are ground and baked into flat unleavened

cakes, or made into beer. Simsim is grown all over the province, but especially near Sherkeila. The seeds are crushed, and the oil so obtained is used for cooking and hair-dressing.

In the Nuba hills, tobacco is grown in considerable quantities for home consumption and sale to the Dinkas. The leaves are cured with wood ashes, and have a pungent and unpleasant flavour. It is smoked in pipes with large earthenware bowls, or made into snuff. Cotton is grown in small quantities, and woven into a coarse cloth called "damur" on hand-looms. It is of no value for export, being very short in the staple. Egyptian cotton has been tried, but it deteriorates rapidly.

Of domestic animals, camels are the most important in the north. They are large, heavy animals of a reddish colour, and can carry from 400 to 600 lbs., but are of little value for riding. When working they are watered every fourth day, but, if only grazing, often go twenty days without water. They should never be taken south of El Obeid, as, in addition to the danger from poisonous plants that thrive on the black soil, they are apt to contract Trypanosomiasis. It is believed that the parasite which causes this disease is carried by the serut fly (*Pangonia magretti*).

In southern Kordofan cattle are all-important, and the Arabs own enormous herds. They are small active animals of the humped variety. The bulls are used for pack purposes, and are extremely docile. The saddle is made of two pads of straw, on which a load of 200 to 250 lbs. is placed. No girth is used, but each animal is ridden by a woman or child, who balances the load. When the ground is boggy there is no animal to equal them, as they will push on at 2 miles an hour where a horse would founder, but, as they are never shod, they soon get footsore on hard ground. They are only watered once a day, and can go anywhere in the south, except near the Kowalib hills, where the tsetse fly is prevalent.

To own a horse is the great ambition of every Arab. The Baggara have considerable numbers, but their quality is indifferent, and they show signs of inbreeding. They are seldom more than 14.2, but have fair bone and will stand a lot of work on poor food. Like the cattle, they are only watered once a day. The Messeria own the best, but, like all the tribes, ride their horses too young and ruin their legs.

The mineral resources are rather limited. Gold was at one time washed near Tira Mandi, but it no longer pays to work it. Iron is plentiful, and is smelted at Um Simeima and Nahud in the north, and between Kurondi and Duleiba south of Jebel Eliri, in Dar Nuba. At Nahud the work is done by people from Bornu. The ironstone is heated with charcoal in cylindrical mud furnaces about 5 feet high and 2 feet in diameter, a draught being kept up by means of bellows. Smelting takes about twelve hours, at the end of which the furnace is broken, and the iron is found in a lump at the bottom.

Salt is found in considerable quantities, chiefly in the north, but there are also deposits in Dar Nuba. It is either found in salt-impregnated earth, which has to be washed to dissolve out the salt, or in salt wells. In both cases the salt is obtained by boiling away the water and collecting the residue.

The forests, with the exception of those containing gum trees, are of little value, and the want of good timber is severely felt, even in the south where there are many large trees. Most of the trees are either small and crooked, or, when large, either very hard like the sunt, a kind of acacia, or too soft like the baobab.

There is a good deal of game in the country. In the north the wild sheep is found among the hills, and the oryx (*O. leucorynx*), western tiang (*Damaliscus korrigum*), and ril (*G. addra*), in the plains. The last is also found in El Akaba. In the central portion of the province there are only *Dorcas* and *Rufirons* gazelle. Near Jebel Kordofan kudu are now scarce, but they are more common further south. On the Bahr el Homr, roan antelope, Jackson hartebeeste, and tiang are common, and Dar Homr must be full of elephant and giraffe in the rains. Rhinoceros are found between the Bahr el Homr and the Bahr el Arab. Lion are found in small numbers all over the south and south-west, and leopard are common in the hills, often doing much damage among the sheep and goats. Cheetah and several kinds of wild cat are also found. Pig and wart-hog occur in the south, and hares are found everywhere.

During the rains, duck, teal, and geese swarm on all open water. Except in the extreme north, guinea-fowl are found everywhere, and at certain times of year sand-grouse come in large numbers. The greater bustard, francolin, and partridge are fairly generally distributed. Ostriches are found in all the more uninhabited parts, but, owing to the thick bush, their feathers are worth little. In Dar Homr the birds are caught young and sold to the Hamars, who keep them in zeribas for the sake of their feathers. The Arabs hunt whenever they can, but have few rifles. The Nubas, however, who own many rifles, have driven nearly all the game out of their country. In such a huge area it is nearly impossible to enforce the game laws.

From the above account, it will have been seen that Kordofan is fairly rich as countries go in the middle of Africa. The revenue is now about £E60,000, and the expenditure £E35,000 a year, so that it can pay its way and contribute its share to the Central Administration. Ten years ago most of the villages had ceased to exist, and the few remaining inhabitants were living in extreme poverty. The majority of the Arabs had fled to other parts of the Sudan, and only returned after the Khalifa's death. It will, however, be a generation or more before the enormous losses from battle and famine can be replaced, though there is now no tribe which cannot be described as fairly well off.

THE CYCLE OF MOUNTAIN GLACIATION.*

By Prof. WILLIAM HERBERT HOBBS, University of Michigan.

The alimentation of glaciers is dependent upon the amount of precipitation and upon the temperature, the former being in large measure determined by the adaptability of the relief for local adiabatic and contact refrigeration of the air. The important factor, temperature, while a function of many variables, yet in a broad way varies directly with latitude and altitude. The size and the form of glaciers is, however, determined not solely by nourishment (mainly in the higher levels), but also to some extent by losses (particularly in the lower levels). In the main, however, the losses are controlled by the same factors as the gains, and maintain to them a determinate proportional relationship. Exceptions to this definite proportion occur when in high latitudes the glacier is attacked directly by the sea (tidewater glaciers), when it is suddenly melted by the heat of a volcanic eruption (Icelandic Jokŭls), or when disturbed by a heavy earthquake (Muir glacier in 1899). In form glaciers will be in large degree determined by the existing topography of the upland, which may generally be assumed to be some product of sub-aërial erosion. Starting, therefore, with the puny glaciers of arid regions in low latitudes, and ending with the high latitude glaciers within areas of excessive precipitation, we run almost the whole gamut of glacier alimentation.

The initial forms of glaciers may be described as snowbank, "newborn" or nivation glaciers, and will at first be few in number and located with wide intervening spaces of upland. The continuance of the nivation process will deepen other intermediate small depressions upon the upland, so that with increasing snowfall additional glaciers will appear in the spaces between the first as the latter are developing their amphitheatres. These cirques, at first no wider than the valleys below, will later cut recesses on either side at the same time that the glacier is pushed farther down the valley and occupies its bed to a greater and greater depth. The grooved upland of this stage, through additional cirque recession in the highlands and through abrasion and plucking in the intermediate levels, becomes at last transformed into the fretted upland, with its network of projecting comb-ridges. Up to this point the glacier ice has perhaps been restrained within valleys, which it has discovered and has progressively widened and deepened. If the initial temperature continues to be lowered, there must come a time when the ice feet from the better-nourished glaciers, or from those with the shortest route to the foreland fronting the range, will debouch upon the plain, spreading as they do so into fans or aprons (see Fig. 21).

* Continued from p. 163.



FIG. 21.—EXPANDED FORE-FOOT OF THE FOSTER GLACIER, ALASKA.

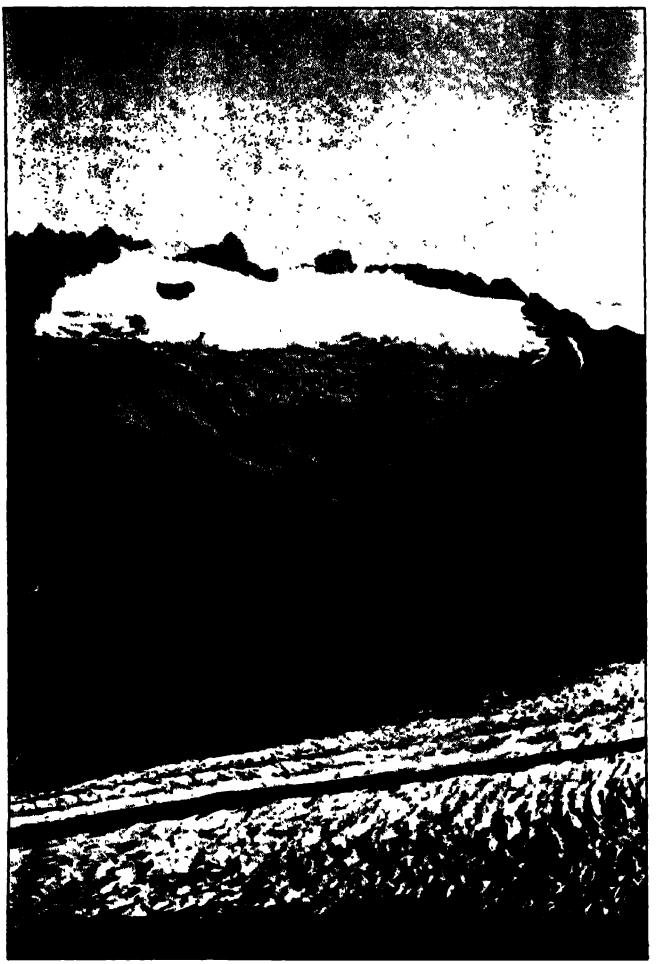


FIG. 22.—TYPE OF PIEDMONT GLACIER.

(*From a photograph of the new model of the Malaspina glacier made under the direction of Lawrence Martin.*)



FIG. 27.—A HANGING TRIBUTARY VALLEY MEETING A TRUNK GLACIER VALLEY ABOVE THE PRESENT WATER-LEVEL ON THE "INSIDE PASSAGE" TO ALASKA.



Later all neighbouring glaciers may arrive at this stage, and by spreading upon the foreland, coalesce with one another to form a single broad apron, such as may be seen in the Malaspina glacier of Alaska. While the glaciers are thus pushing out upon the foreland they have been deepening in their valleys, and eventually come to overtop portions of the lateral comb-ridges of the fretted upland, thus moulding the sharpened needles into rounded shoulders of rock. In places the glaciers from adjacent valleys will flow together through the irregular depressions, separating peaks and producing islands or *nunataks*.

But the increased size of the individual glaciers of the range has corresponded to increased activity of cirque recession in the high altitudes, and this has resulted in the formation of cols or passes through the range. Snow which has been divided at the summit, as has water by a divide, may now be consolidated into glacier ice over the col before the separation is made. Thus it comes about that without a definite cirque, glaciers will transect the range flowing in opposite directions from a central icefield. Such a broad central icefield is found to-day between Mount Newton of the St. Elias group and Mount Logan to the eastward.*

The advance of the glacier ice up the sides of the valleys, so as partially to submerge the lateral comb-ridges, may not end until all are thus covered and the ice flows away from the central broad area, radiating in many directions. Here the process of cirque recession, which has mainly sculptured the rock in the higher altitudes, comes to an end as we reach the ice-cap stage of glaciation. Transitions toward such ice-cap glaciers are to be found to-day in the Elbruz and in the Kasbek region of the Caucasus, as well as in the Justedalsbrăen of Norway, where a central elevated snow-field (fjeld) is the common *névé* of several glaciers radiating in as many directions.† It is of considerable interest to note that in the Caucasus district, at least, there is evidence that rocky comb-ridges are submerged beneath the ice and make their appearance so as to separate the marginal ice-tongues. The persistence of an ice-cap over a mountain region, as is clear from study of the glaciated mountains in Norway, tends to largely obliterate relief forms characteristic of mountain glaciers as they are replaced by the rounded shoulders of *roches moutonnées*. As soon, however, as nourishment has been so far reduced that the higher points once more appear from beneath their snow cover, cirque recession will begin again, and if long continued the evidence of the ice-cap will disappear. Lack of glacial scratches or polish in uplands sapped by this process should not be allowed to weigh too heavily in reconstructing the glacial history of the district.

---

* Filippo di Filippi, 'The Ascent of Mount St. Elias (Alaska),' by H.R.H. Prince Luigi Amadeo di Savoia, Duke of the Abruzzi (English translation). Panorama at end of volume (unnumbered) from an elevation of 16,500 feet.

† H. Hess, 'Die Gletscher. Braunschweig,' 1904, pp. 65–68.

Classification of Glaciers based upon Comparative Alimentation.

Relation of Glacier to its Bed.—From what has been said in the preceding section concerning the changes of glaciers in correspondence to a progressive augmentation of glacial conditions, it must be evident that any attempt to use each circumscribed body of snow and ice as a unit in name or in type will lead to endless confusion. Ice bodies being extremely sensitive to changes in annual temperature, a difference of one degree may be sufficient to join many ice bodies into one, or to differentiate one body into many. If, however, we examine the distribution of snow and ice masses within the valley which they either wholly or partially occupy, it will be seen that there are relatively few distinct glacier types, and that the coalescence of smaller ice masses, or the breaking up of larger ones, does not necessarily alter the type exemplified.

The more important types called for by analysis on this basis do not differ greatly from those adopted by Chamberlin and Salisbury,* which seem to be the ones most generally recognized. The genetic relationships of these types are here first brought out, together with distinct and intermediate transitional forms. In the following table, excepting the initial type and the glaciers with inherited basins, the arrangement is in the main one of decreasing alimentation:–

Nivation type (Bighorn glaciers).
Ice-cap type (Jökulls of Iceland).
Piedmont type (Malaspina glacier).
Transection type (Yakutat glacier).
Expanded-foot type (Davidson glacier).
Valley type, normal subtype (Baltoro glacier).
  Hanging glacierets (Triest glacier).
  Cliff glacierets (Lefroy cliff glacieret).
Valley type, Tide-water sub-type (Harriman-Fjord glacier).
Inherited basin type (Illecillewaet glacier).
  Reconstructed type (Victoria-Lefroy glacier).
  Volcanic cone type (Nisqually glacier).
  Cauldron type (Caldera glacier).
Alpine type (Nicolaithal glacier).
Horseshoe type (Mount Lyell glacier).

Nivation Type.—This type of glacier has also been called "new-born" or "snowbank" glacier, and represents the initial stage of glaciation. Though small in size, such glaciers differ markedly from those of the same dimensions which cling to the steep walls of a large cirque (see horseshoe glaciers below), and which Tarr has referred to as "dying glaciers."† Numerous examples of snowbank glaciers are furnished by the Bighorn mountains of Wyoming. Other known types of mountain glaciers are all represented, and follow naturally in sequence during a receding hemicycle of glaciation. In their discussion we shall conceive

* 'Geology,' vol. 1, chap. v.

† R. S. Tarr, "Valley Glaciers of the Upper Nugsuak Peninsula, Greenland," *Am. Geol.*, vol. 19, 1897, p. 265 and fig. 2.

a mountain district to pass by slow stages from a culmination of glacial conditions toward a comparatively genial climate.

Ice-cap Type.—Though in form and general characters resembling so-called continental glaciers, the ice-caps by reason of their smaller dimensions form a connecting-link with mountain glaciers, and are usually developed upon small plateaus or uplands. They correspond to conditions of extremely heavy snow precipitation, and in consequence have not been found fully developed outside the Polar regions (see inherited basin glaciers below).

The normal type of ice-cap glacier is represented by the mantle over Rodcliff peninsula, north of Inglefield gulf in Greenland.* It suffers no interruption from mountain peaks, but the ice creeps out in all directions from a central area, and sends out marginal lobes or tongues which much resemble, save for their whiter surface, the snouts of valley and alpine glaciers (see below). The Jökulls of Iceland are very similar, and form flatly arched or undulatory domes of ice having short lobes about their margins (see Plate II., Fig. 1). The largest of these, the Vatnajökull, has an area of 8500 square kilometres.† In Scandinavia the small plateau glaciers with marginal tongues of proportionately greater length, such as the Justedalsbräen, serve to connect this type with that of the valley glaciers (see Plate II. Fig. 2).‡ The *Richtojencis* on Kerguelen island, recently described by the German South-polar Expedition, seems to be very similar.§ According to Meyer, the ice-mass upon the summit of Kilimandjaro in Africa is an "ice carapace," having much resemblance to the ice plateaus of Scandinavia.‖

Piedmont Type.—Piedmont glaciers, like ice-caps, correspond to conditions of exceptionally heavy precipitation, and are only known from polar and sub-polar regions. In contrast to ice-caps, the existing examples are found in connection with mountains of strong relief, so that the snow and ice which in ice-caps find their way slowly out to the margin of a flat or gently sloping plateau, are in the piedmont glacier discharged through valleys from lofty highlands to debouch upon the foreland at the foot of the range. The well-known type is the Malaspina glacier of Alaska, explored and described by Russell (see Fig. 22 and Plate II. Fig. 3).¶ Near it and farther to the west is the

* T. C. Chamberlin, "Glacial Studies in Greenland," IV., V., *Jour. Geol.*, vol. 3, 1895, pp. 199, 470.

† Th. Thoroddsen, "Island, Grundriss der Geographie und Geologie. V. Die Gletscher Islands," *Pet. Mitt.*, Erg. Bd. 32 (Nos. 152–153), 1906, pp. 163–208, map, pl. xii.

‡ H. Hess, 'Die Gletscher' (Map 3).

§ Emil Werth, 'Aufbau und Gestaltung von Kerguelen. Sonderabd. aus Deutsch. Südpolar Expeditionen, 1901–1903,' vol. 2, pp 93–183, pls. 9–14, 3 maps.

‖ Hans Meyer, 'Der Kilimandjaro, Reisen und Studien,' pp. 436. Berlin, 1898 (reviewed by Rabot).

¶ I. C. Russell, "An Expedition to Mount St. Elias," *Nat. Geogr. Mag.*, vol. 3, 1891, pp. 52–204, pls. 2–20. See also Filippi, *loc. cit.*



PLATE II.—TYPES OF MOUNTAIN GLACIERS.

Fig. 1.—Ice-cap type, Vatnajokull, Iceland. (After Thoroddsen.)
Fig. 2.—Ice-cap type, Justedalsbræen, Norway. (After Hess.)
Fig. 3.—Piedmont type, Malaspina glacier, Alaska. (After Russell and Kerr.)
Fig. 4.—Valley type, Baltoro glacier, Karakorum Himalayas. (After W. M. Conway.)
Fig. 5.—Valley type, Tasman glacier, New Zealand. (After v. Lendenfeld.)
Fig. 6.—Valley type (Tidewater glacier), Harriman fjord glacier, Alaska. (After Gannett.)
Fig. 7.—Alpine type, Nicolaithal glacier, Alps. (After Baedeker.)
Fig. 8.—Alpine type, Mer de Glace, Alps. (After Baedeker.)
Fig. 9.—Alpine type, Rathong glacier, Kangchengunga Himalayas. (After Garwood.)
Fig. 10.—Horseshoe type, Lhonak glacier, Kangchengunga Himalayas. (After Garwood.)
Fig. 11.—Horseshoe type, Asulkan glacier, Selkirks. (After A. O. Wheeler.)
Fig. 12.—Horseshoe type, Wenkchemna glacier, Canadian Rockies. (After A. O. Wheeler.)
Fig. 13.—Horseshoe type, Arapahoe glacier, Colorado. (After Fenneman.)
Fig. 14.—Inherited basin type, Great Aletsch glacier, Alps. (After Baedeker.)
Fig. 15.—Inherited basin type, Illecillewaet glacier, Selkirks. (After A. O. Wheeler.)
Fig. 16.—Inherited basin type (reconstructed glacier), Victoria glacier, Canadian Rockies (After Scherzer.)

Bering glacier of about the same size.* To the east of the Malaspina glacier is the Alsek, a much smaller piedmont glacier.† In Chili south of 42° S. lat. are found other piedmont glaciers, among them the San Rafael.‡ During Pleistocene times piedmont glaciers existed in many mountain districts, notably, however, the Alps § and the Rocky mountains of North America.‖ A transition from the piedmont type toward the continental glacier is illustrated by the Friederickshaab glacier in Greenland, which pushes its front out upon the foreland as an extension of the inland ice of that continent.

Above the ice apron and within the range, the piedmont glacier bears a close resemblance to the valley type (see below), though in general it may be said that its valleys are filled to a much greater depth. The largest stream feeding the fan of the Malaspina glacier has

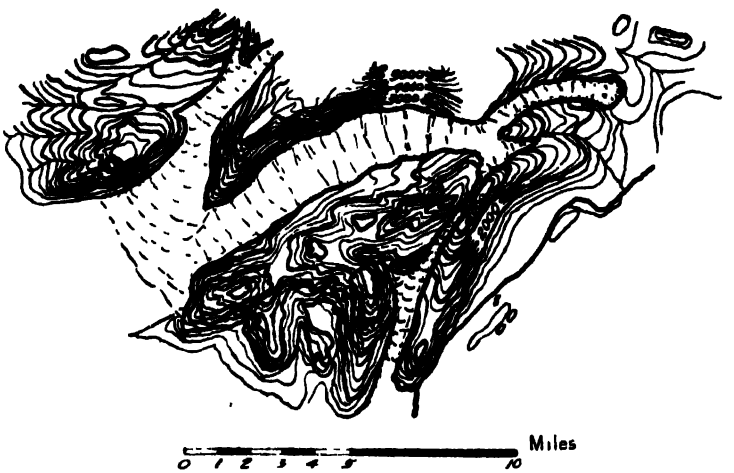


FIG. 23.—MAP OF A TRANSECTION GLACIER. THE SHERIDAN GLACIER NEAR THE COPPER RIVER IN ALASKA. (AFTER G. C. MARTIN.)

been named the Seward glacier, while other tributaries are known as the Agassiz and the Tyndall (see Fig. 2, Plate III.). It is interesting to note that however steep these feeders to the ice-apron may be, the

* Roughly outlined on map of Alaska to accompany "The Geography and Geology of Alaska," by Brooks (Prof. Pap. U.S. Geol. Surv., No. 45, 1906, plate in cover). For details of marginal portion and description, see G. C. Martin, 'Bull. 335 U.S. Geol. Surv.,' 1908, pp. 46–48, and pls. i., ii. and v.

† E. Blackwelder, "Glacial Features of the Alaskan Coast between Yakutat Bay and the Alsek River," *Jour. Geol.*, vol. 15, 1907, pp. 428–432, map.

‡ See Rabot, 'La Géographie,' vol. 3, 1901, p 270. See also Hess, 'Die Gletscher,' p. 63.

§ Penck u. Brückner, 'Die Alpen im Eiszeitalter, especially vol. 2, 1909, map opposite p. 896.

‖ Fred H. H. Calhoun, "The Montana Lobe of the Keewatin Ice-sheet" Prof. Pap. No. 50, U.S. Geol. Surv., 1906, pp. 14–21, map pl. i.

latter always shows an exceedingly flat slope, and is, moreover, relatively stagnant.

Transection Type.—In a late stage of augmenting glacial conditions or in an early stage of the receding hemi-cycle, what is essentially one body of ice may be divided over a pass and flow off in opposite directions toward different margins of the range. For this type, exemplified by the nunatak glacier of Alaska, Tarr has used the term "through glacier," * and Blackwelder has instanced the Yakutat glacier and perhaps the Beasley within the same region.† Such glaciers, which may be referred to as the *transection type*, are often the highways which give readiest access to the hinterland. A glacier of this type, which has been carefully mapped, is the Sheridan glacier near the mouth of the Copper river in Alaska (see Fig. 23).‡ An excellent panorama of one of the grandest transection glaciers has been furnished by Sella.§ The glaciation of the Grimsel pass in Switzerland clearly indicates that at one time a glacier of this type was parted over the present divide, one stream passing down the Rhone valley, and the other down the Häsli valley toward Meyringen. Far greater exhibits of the same sort are to be found in the Southern Andes.‖

Expanded-foot Type.—When a piedmont glacier draws in its margin as it shrinks with the coming of a warmer climate, the several ice-streams which feed the apron of ice upon the foreland end in small fans at the mouths of the individual valleys. Perhaps the best known example of such an expanded-foot glacier is the Davidson, on the Lynn canal in Alaska, though the Foster and Mendenhall glaciers of the same district are similar (see Fig. 22). The Miles and Childs glaciers, near the Copper river, are also of this type, and have been mapped by Martin (see Fig. 24 *a*).¶ The transection glacier known as the Sheridan is in the same vicinity, and has an expanded forefoot—a good illustration of the combination of these two types in one (see Fig. 23). A larger example of the expanded forefoot than any thus far mentioned is the Klutlan, in the Yukon basin, whose foot extends a number of miles beyond the front of the St. Elias range (see Fig. 24 *b*).** The Martin river glacier in the Copper river district affords another example, since it expands for a distance of over 20 miles. It is, however, partially restrained by a range of hills rising on its southern margin, and by

* *Bull. Am. Geogr. Soc.*, vol. 38, 1906, p. 149. See also Prof. Pap. No. 64, U.S. Geol. Surv., 1909, pp. 35-36, 105, pls. vii.–viii.

† *Jour. Geol.*, vol. 15, 1907, p. 432.

‡ G. C. Martin, 'Bull. 284, U.S. Geol. Surv.,' 1906, pl. 12.

§ Filippi, *loc. cit.*

‖ Argentine-Chilian boundary, maps.

¶ G. C. Martin, *loc. cit.*

** C. W. Hayes, "An Expedition through the Yukon District," *Nat. Geogr. Mag.*, vol. 4, 1892, pp. 152. See also map of Mendenhall and Schrader, Prof. Pap. U.S. Geol. Surv., No. 15, 1903, fig. 4, p. 41.

Martin has been considered intermediate between the piedmont and valley types.*

Valley or Dendritic Type.—Retiring within the range as warmer temperatures succeed to more rigorous conditions, glaciers are of necessity restricted to individual valleys and their tributaries. They come thus to have a plan as truly arborescent as that of water-drainage, and they may in this stage be called dendritic or valley glaciers. Unfortunately, the term "valley glaciers," in every way appropriate, has been generally applied to glaciers which occupy valley heads only, and hence the term must be redefined in its natural rather than its inherited



FIG. 24.—(*a*) MAP OF THE MILES GLACIER IN ALASKA (AFTER G. C. MARTIN); (*b*) MAP OF THE KLUTLAN GLACIER IN THE YUKON BASIN OF ALASKA (AFTER MENDENHALL AND SCHRADER).

significance. This glacier type geographers are most familiar with in restorations of Pleistocene glaciers,† but it is none the less a common form to-day in districts more distant from commercial centres, and hence less easily accessible for study. From the Karakoram Himalayas, the Baltoro, Hispar, and Biafo glaciers, all of this type, have been described and carefully mapped by Sir Martin Conway.‡ An outline map of the Baltoro glacier is reproduced in Plate II. Fig. 4, and one of the Hispar glacier in Fig. 25. Other valley glaciers, generally less extensive, have

* G. C. Martin, "Geology and Mineral Resources of the Controller Bay Region, Alaska," Bull. No. 335, U S Geol. Surv., 1908, pp. 48–49, pl. i., ii., and v.

† One of the best maps of such a restored valley glacier of Pleistocene age is that of the Kern valley of California (see Lawson, *loc. cit.*, pl. xxxi.).

‡ W M. Conway, 'Climbing and Exploration in the Karakoram Himalayas,' maps and scientific reports. 1894.

been mapped by Garwood * from the Kangchenjunga Himalayas. In the Central Tian Shan mountains are other glaciers of this type.† In

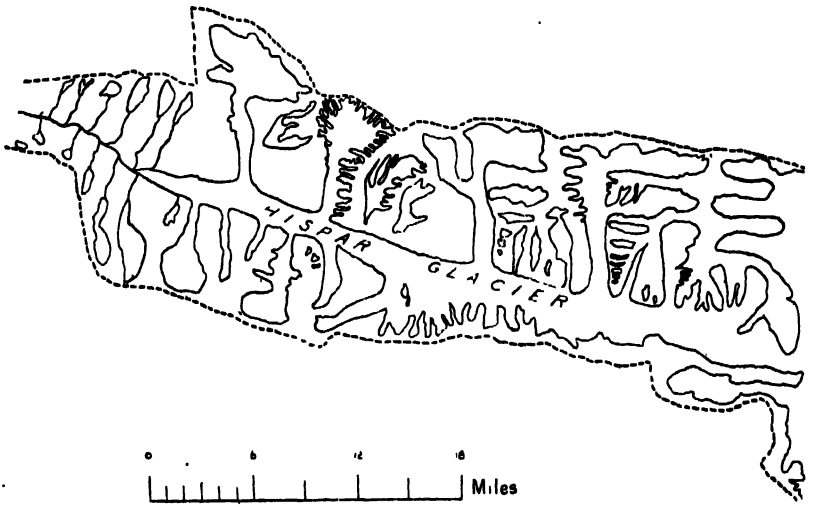


FIG. 25.—OUTLINE MAP OF THE HISPAR GLACIER, KARAKORAM HIMALAYAS. (AFTER CONWAY.)

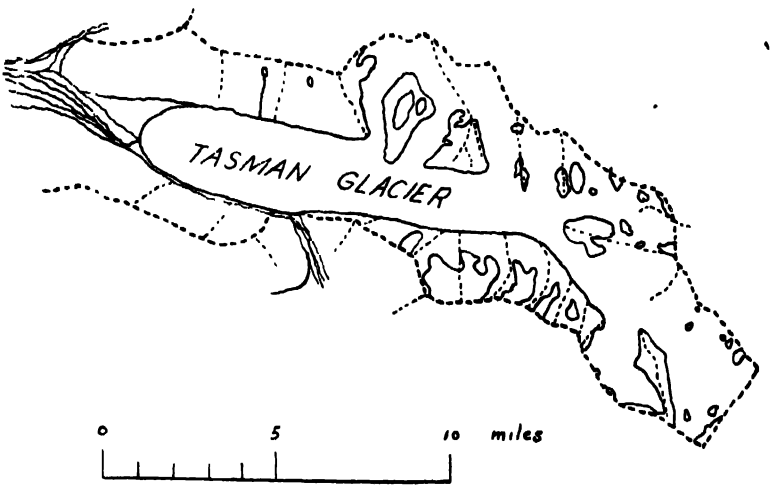


FIG. 26.—OUTLINE MAP OF THE TASMAN GLACIER, NEW ZEALAND. (AFTER V. LENDENFELD.)

* E. J. Garwood, "Notes on Map of the Glaciers of Kangchenjunga, with Remarks on some of the Physical Features of the District," *Geogr. Journ.*, vol. 20, 1902, pp. 13–24, plate.

† Max Friederichsen, "Die heutige Vergletscherung des Khan-Tengri-Massives und die Spuren einer diluvialen Eiszeit im Tiën-schan," *Zeit. f. Gletscher K.*, vol. 2, 1908, pp. 242–257.

the New Zealand Alps the Tasman glacier furnishes another example of the same valley type* (see Fig. 26 and Plate II., Fig. 5). Still other examples have been described from the mountains of Alaska, such, for example, as the Kennicott and Chistochina glaciers.†

Comparison of a number of examples of valley glaciers may illustrate as many different stages in the retreat of the glacier from a position in which it occupied its entire valley to the retirement almost within the mother cirque at the head. The examination of the vacated valley has taught us that the tributary glaciers erode their beds less deeply than the trunk stream lying in the main valley. It is the surfaces of the ice-streams only that are accordant, and hence a lack of accordance in the bed-levels has yielded the so-called hanging valleys with their characteristic ribbon falls. Nowhere can the hanging valleys be observed in greater perfection or on a grander scale than in the troughs, now largely abandoned of ice which enter the great fjords of the "inside passage" to Alaska (see Fig. 27).‡

As the foot of the trunk glacier retires up its valley, the lateral tributaries which are nearest the mouth of the valley are at first separated from it and develop their own front moraines. Later they are left high above the main stream as a series of *hanging glacierets* (see Fig. 28).§ The series of hanging glacierets, as will be observed in the maps of the Baltoro and Hispar glaciers, often persist above the main valley well below the foot of the trunk stream.

Inherited Basin Type.—The valley type of glacier hardly appears in the Alps at all, though the Great Aletsch glacier might perhaps be regarded as a small and imperfect example. The size and characters of the latter are, however, for the district in which it lies, abnormal and to be accounted for by the existence of a natural interior trough lying between the Berner Oberland on the one side and the high range north of the Rhone valley upon the other, from which basin small outlets only are found through the southern barrier (Plate II. Fig. 14). A

---

* R. v Lendenfeld, "Der Tasman Gletscher und Seine Umrandung," *Pet. Mitt.* Erg. Bd., vol. 16, 1884, pp. 1–80, map, plate I.

† W. C. Mendenhall and F. C. Schrader, "The Mineral Resources of the Mount Wrangell District, Alaska," Prof. Pap. U.S. Geol. Surv., No. 15, 1903, pl. iv. and ix. See also Brooks, Prof. Pap. U.S. Geol. Surv., No. 45, map, plate xxxiv.

‡ R. S. Tarr, "Glacier Erosion in the Scottish Highlands," *Scot. Geogr. Mag.* vol 24, 1908, pp. 575–587.

§ The term "hanging glacier," now used in a variety of senses, is, it is believed, best retained with this restricted meaning. The term "cliff glacier," generally considered synonymous, may be restricted to the long strips of incipient glacier ice which sometimes parallel the main valleys on narrow terraces above precipitous cliffs which are primarily determined by the rock structure (see *ante*, p. 154; and also Matthes 'Appalachia,' vol. 10, 1904, p. 262). In the sense here employed, a hanging glacier is the equivalent of the *Kahr Gletscher*, a term quite generally employed in Germany. The term "horseshoe" glacier we have here suggested for an essentially different type of glacieret (see below, p. 280).

better example, however, of this special type of glacier, in which the inherited topography has exercised a greater influence upon the glacier form than has the auto-sculpture, is furnished by the Illecillewaet glacier of the Selkirks (see Fig. 29), which, from a roughly rectangular

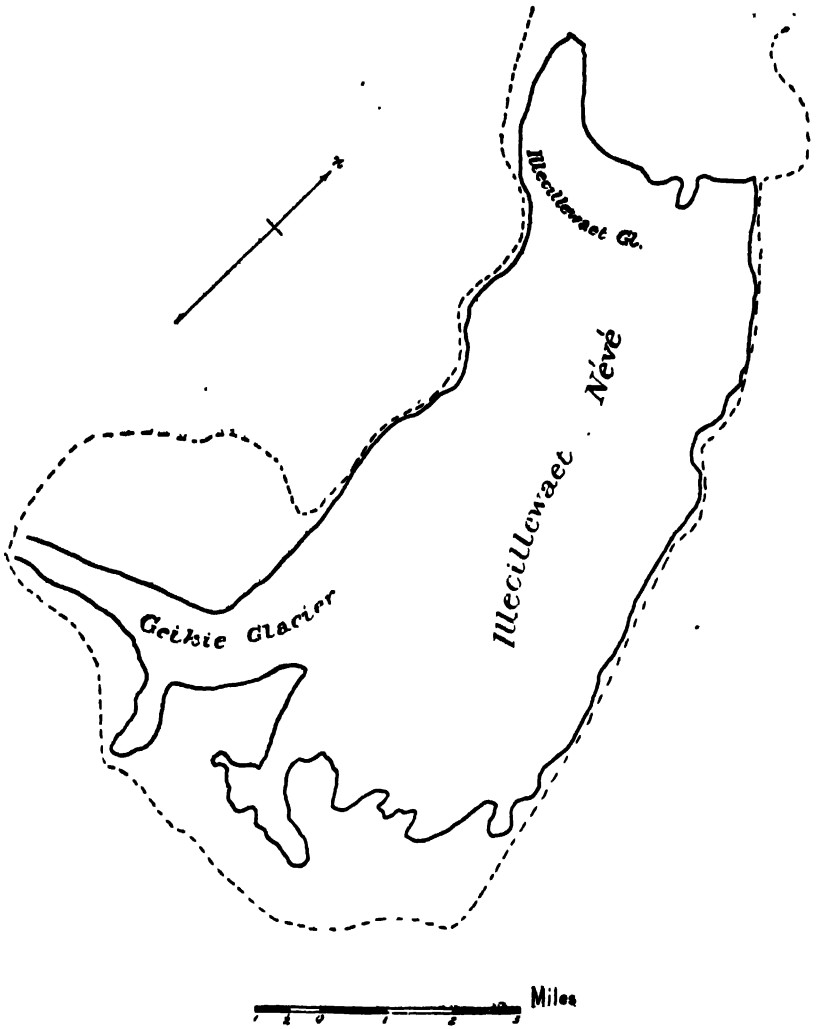


FIG. 29.—OUTLINE MAP OF AN INHERITED BASIN GLACIER, THE ILLECILLEWAET GLACIER OF THE SELKIRKS. (AFTER WHEELER.)

snow-icefield lying between parallel ridges, sends out short tongues leading in different directions. A glacier of this type, with a moderate increase only of alimentation, would produce a small ice-cap.

Another abnormal form of glacier due to the peculiarities of the basin which it inherited, is illustrated by the Victoria glacier in the

Canadian Rockies, a glacier having no cirque, but only a couloir (the so-called "death-trap") in its stead (see Fig. 30). In this case the *névé* which feeds the glacier is found high above upon the cliff—a true cliff glacieret—and this *névé* avalanches its compacted snow upon the surface of the Victoria glacier, which thus well illustrates the *reconstructed type.**

Again, glaciers may develop, not upon a gently domed and variously moulded pre-glacial upland such as we have thus far had under consideration, but upon the sharply conical volcanic peaks which in temperate and tropical regions push their heads from the mountain upland far up above the snow-line. In such cases, regular cirques cannot develop at the heads of the radiating ice-streams, but, on the contrary, very irregular and mutually destructive forms will result (see Fig. 31).† This is the more true because of the loosely consolidated tuffs of which such cones are always built up. If sufficiently lofty, the result may be a small carapace or ice-cap such as is found to-day upon the summit of Kilimandjaro in Africa. On the other hand, a partially ruined crater may furnish a *natural* basin or cauldron for a small glacier—*Cauldron Type.*‡

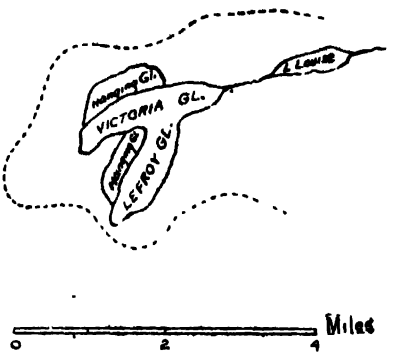


FIG. 30.—OUTLINE MAP OF RECONSTRUCTED GLACIER—THE VICTORIA AND LEFROY GLACIERS IN THE SELKIRKS. (AFTER WHEELER.)

Tide-water Type.—In high latitudes glaciers sometimes descend to the level of the tide-water in fjords which continue their valleys. In such cases, the glacier front is attacked mechanically by the waves and is further melted in the water. In place of the convexly rounded nose, so characteristic of the other types, there develops a precipitous cliff of ice from which bergs are calved, and the glacier front in consequence is rapidly retired (Plate II. Fig. 6). Unhappily, the local term "living glaciers" has been applied to this type in Alaska; "dead glaciers," in the same usage, being applied to glaciers which yield no icebergs. The slopes of the glacier surface and the measure of projection of the ice above the water-level both render it probable that in most cases, at least, the ice-foot everywhere rests on a solid basement.

---

* See map and description of this glacier by Scherzer, "Glaciers of the Canadian Rockies and Selkirks," Smith Contrib., No. 1692, 1907, chaps. 2–3.

† Cf. I. C. Russell, "Glaciers of Mount Ranier," 18th Ann. Rept. U.S. Geol. Surv., 1898, pp. 329–423.

‡ Hans Meyer, "Der Calderagletscher des Cerro Altar in Equador," *Zeit. f. Gletscherk.*, vol. 1, 1906–7, pp. 139–148.

On the other hand, the Turner glacier, debouching into Disenchantment bay, Alaska, shows a flat and relatively low front section, which is separated from the remaining and sloping portion of the glacier by a steep ice-fall. This has led Gilbert to think that the lowest terrace is floated in the water.*

Alpine Type.—A good deal of misunderstanding is current in regard to alpine glaciers, often unhappily referred to as valley glaciers. Examination of any good map of Switzerland suffices to show that with the possible exception of the Great Aletsch, an abnormal type, Swiss glaciers hardly extend into valleys at all. We have too long held the alpine glacier close before the eye, and so have much exaggerated its importance. When Alaskan, Himalayan, and New Zealand glaciers are brought into consideration, the real position of the Swiss type becomes apparent. In reality the glaciers of the Alps, far from occupying valleys, do not even fill the mother cirques at the valley heads. Here they lie, side by side, joined to one another like the radiating sticks within a lady's fan, for which reason they have been called *Zusammengesetzte Gletscher* (see Fig. 10 and Plate II., Fig. 7). The *mer de glace*, next to the Great Aletsch the largest in Switzerland, with its numerous tributaries, it is true, completely fills a cirque, but only that of a tributary valley (Plate II. Fig 8).† Alpine glaciers are hence sheaves of small glaciers which are wholly included within the mother cirques, or which fill and extend out from the secondary or tributary cirques. In the Nicolai Valley of Switzerland, the Gorner glacier and its several tributaries (see Fig. 10), with the Findelen and Längenfluh, the Theodul, Furgen, and Z'Mütt glaciers together, but partially fill the mother cirque of which Zermatt is the centre. Lining the valley below upon either side are eighteen to twenty glacierets, all resting upon the *alps*, or high mountain meadows.

High up in the Chamonix valley, below the debouchure of the *mer de glace*, similar glacierets are lodged upon the ledge below the sharp needles of de Charmoz, de Blatière, du Plan, and du Midi, their frontal moraines making a continuous series of scallops above the shoulder of the valley. Similar but smaller series are shown in Figs. 20 and 32.

Horseshoe Type.—The final representative type in our series, unlike the alpine glacier, is no longer made up of streams joined together in

* G. K. Gilbert, 'Harriman Alaska Expedition,' vol. 3, "Glaciers," 1904, pp. 67-68. See also Tarr, "The Yakatat Bay Region, Alaska, Physiography and Glacial Geology." Prof. Paper No. 64, U.S. Geol. Surv., 1909, pp. 39, 40, pl. x*a*.

† This valley is a large hanging valley tributary to the Chamonix valley, which latter alone is comparable in size to those that form the beds of the Baltoro, Hispar, and Tasman glaciers. If at first it seems that confusion may result from the introduction of valleys of different orders of magnitude, a second thought suffices to show that the difficulty is of theoretical rather than of practical importance, at least so far as existing examples of glaciers are concerned.



FIG 31 - IRREGULARLY BOUNDED NEVES UPON THE VOLCANIC CONE OF MOUNT RANIER

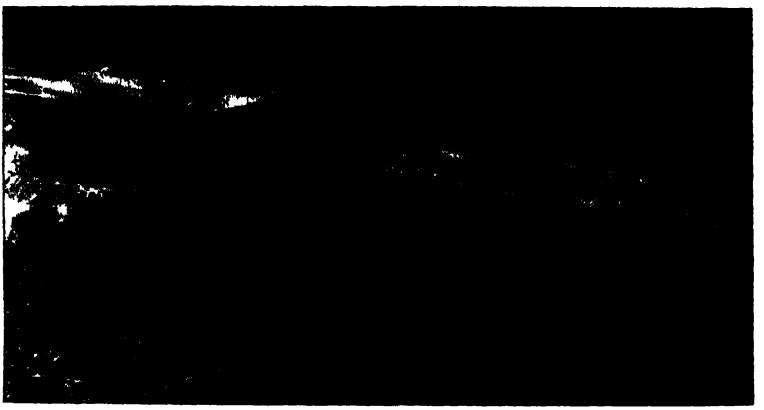


FIG 32 SERIES OF HANGING GLACIERETS WHICH EXTEND THE ASULKAN GLACIER IN THE SELKIRKS



FIG 33 —VIEW OF THE ASULKAN GLACIER, A HORSESHOE GLACIER IN THE SELKIRKS.



FIG 35.—VIEW LOOKING DOWN THE VALLEY OF FISH CREEK FROM THE ASULKAN GLACIER, THE HERMIT RANGE IN THE DISTANCE. SELKIRK MOUNTAINS



FIG 37.—VIEW OF THE WINKCHEMNA GLACIER AT THE HEAD OF THE VALLEY OF THE TEN PEAKS IN THE CANADIAN ROCKIES.

sheaves. With further shrinking of alpine glaciers corresponding to higher air temperatures, the glacier front retires until it approaches the cirque wall. It now takes on, either as an individual or as a collection of small remnants, a broadly concave margin, which is in contrast to the convex or convexly scalloped front characteristic of all other glacier types. This type of glacieret has been sometimes described under the names hanging and cliff glaciers.* Reasons have been presented for restricting both these terms to special and different varieties

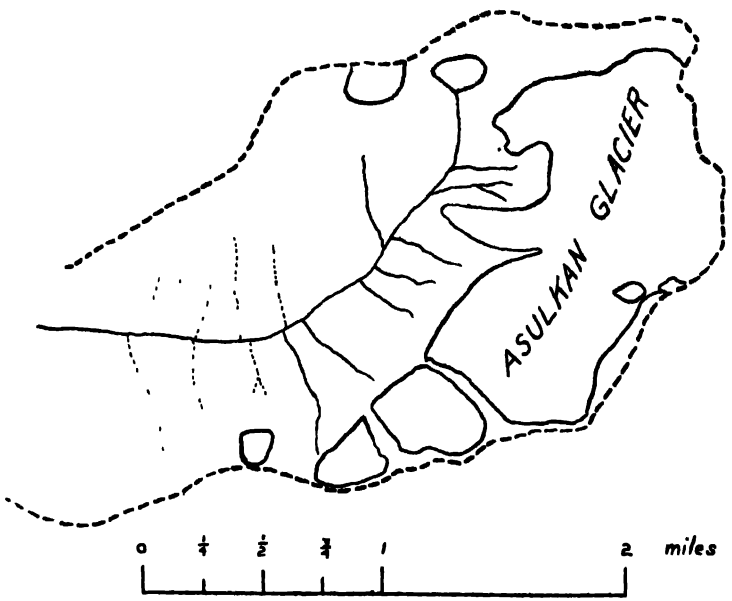


FIG. 34.—OUTLINE MAP OF THE ASULKAN GLACIER IN THE SELKIRKS.

of small glaciers or glacierets. It is proposed to use here the term "horseshoe glacier" for these last remnants of larger glaciers hugging the wall of the cirque. Most of the glaciers of North America outside of Alaska belong in this class. As already implied, they are generally broader than long, and usually have concave frontal margins. Excellent examples of this type are furnished by the "Horseshoe glacier" at the head of the Paradise valley in the Canadian Rockies and by the Asulkan glacier in the Selkirks (see Figs. 32–34.) The Mount Lyell glacier, long known and cited from the High Sierras of California, is, however, an equally good type.† For further illustration of the type the Wenkchemna glacier in the Canadian Rockies has been chosen (see

* See footnote on p. 277.

† I. C. Russell, "Existing Glaciers of the United States," 5th Ann. Rept. U.S. Geol. Surv., 1885, pp. 314–328, pl. 40.

Figs. 36, 37 and Plate II. Fig. 12). The Asulkan and Wenkchemna glaciers have both been described by Scherzer as belonging to the piedmont type. The former hugs the cirque wall with an incurving frontal margin, and is extended by a series of small hanging glacierets (see Fig. 32). Unlike the piedmont glaciers, it has no foreland on which to expand, but lies at the head of a typical U-shaped valley (see Fig. 35). The Wenkchemna glacier occupies a similar position in the great cirque outlined by the Ten Peaks at the head of a tributary valley to the Bow (see Figs. 36, 37).*

In Plate II. the various types of glacier are shown on approximately the same scale, and from this it will be appreciated that the size, directly dependent upon the alimentation of the glacier, must be a determining factor in classification. The ice-cap and piedmont glaciers will in this respect overlap, being differentiated by the accentuation of the relief of the land, though in the main the ice-cap is the larger. For the other types the proportion of the glacier-carved valley which is still occupied by the ice will determine the form and the more important characters of the existing glacier. It is important, therefore, in order to determine the type to which an individual glacier belongs, to map the divide surrounding the valley, as well as the boundaries of the glacier which lies within it.

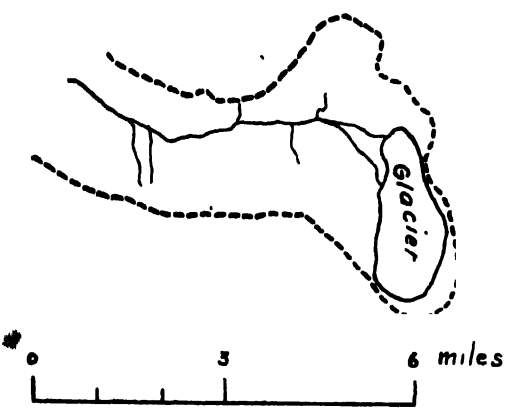


FIG. 36.—OUTLINE MAP OF THE WENKCHEMNA GLACIER IN THE CANADIAN ROCKIES.

Termination of the Cycle of Glaciation.

Configuration of the Glacier-bed when uncovered.—No one who has climbed a mountain glacier to its *névé* has failed to be struck by the alternation of plateau and precipitous slope, for the surfaces of mountain glaciers are, with few exceptions, broken into broad terraces. Each steep descent is well understood to overlie a corresponding fall in the glacier-bed. Perched upon the high cliffs which overlook the Pinnacle pass

* Sherzer, Smith Contrib., No. 1693, 1907, chaps. iv. and vii. The only resemblance to the piedmont glacier is in the shape. Neither glacier expands upon a foreland, but both lie in cirques at the heads of U-shaped valleys. They have no appreciable tributaries, and, as already pointed out, piedmont glaciers are necessarily of large size, corresponding to excessive precipitation.

during his first attack upon Mount St. Elias, the late Professor Russell wrote of these terraces *—

"Were the snow removed and the rock beneath exposed, we should find terraces separated by scarps sweeping across the bed of the glacier from side to side. Similar terraces occur in glaciated cañons in the Rocky mountains and the Sierra Nevadas, but their origin has never been explained. The glacier is here at work sculpturing similar forms, but still it is impossible to understand how the process is initiated."

The generalized description of uncovered glacier-beds within the High Sierras of California—perhaps as well as any that has been penned—lays the emphasis upon the more essential and impressive characters †—

"The amphitheatre bottom terminated forward in either a cross cliff or a cascade stairway, descending, between high walls, to yet another flat. In this manner, in steps from flat to flat, common enough to be characteristic, the canyon made descent. In height, however, the initial cross cliff at the head dominated all. The tread of the steps in the long stairway, as far as the eye could follow, greatly lengthened in down-canyon order."

The grade in the treads of the giant stairway is often reversed, so that they come to be occupied by the characteristic rock-basin lakes, long and ribbon-like, or strung along the valley like pearls upon a thread.

Since Russell's meditation above the Pinnacle pass, nearly a score of years ago, considerable study has been given to the subject of erosion upon the glacier-bed. In the Alps Penck and Brückner have enunciated their "law of adjusted cross-sections." The glacier, on invading the mature river-valley, characterized by uniformly forward grades and by accordance of trunk with side valleys, will, in general, be so modified that a small cross-section corresponds to a deepening of the valley.‡ Thus will be brought about the hanging side valley, and a local modification of, and perhaps even a reversal of, direction in the grade of the main valley.

If the rock be not homogeneous throughout, or if it be unequally intersected by joint planes, further abrupt changes in grade will result. The two processes which are effective in deepening the bed of the valley are well recognized to be abrasion and plucking. Greater softness in the rock will correspond to greater depth of abrasion, while the perfection of the parting planes will directly determine the amount of quarrying in the rock by plucking. Abrasion being greatest on the

---

* I. C. Russell, "Expedition to Mount St. Elias," *Nat. Geogr. Mag.*, vol. 3, 1891, pp. 182–183.

† Johnson, *Journ. Geol.*, vol. 12, 1904, pp. 570–571.

‡ A. Penck, *Journ. Geol.*, vol. 12, 1904, pp. 1–19.

upstream side of any irregularity in the bed, and plucking being largely restricted to the downstream side, the tendency of these processes working together will be to produce steps of flat tread but steep riser, the latter coinciding with the nearly perpendicular planes of jointing.

It is further probable that the cliffs at the lower margins of the terraces are in many cases, at least, considerably recessed through the operation of a sapping process in every way analogous to that which obtains at the base of the Bergschrund, or *Randspalte*. So soon as the rock-cliff has been formed, either below a narrowing of the valley or where a hard layer of rock transects it, the glacier will descend over it in an ice-fall, showing gaping transverse crevasses. These fissures in the ice may be sufficiently profound to admit the warm air at midday to the rock joints, and so bring about with the nightly fall of temperature a mechanical rending of the rock.

Basal cliff sapping being downward as well as backward, the reversed grades of the treads in the staircase could be thus explained. In the Alps, Penck distinguishes especially one larger cliff in the staircase which separates the head cirque from the trough valley (*Trogthal*).

Water-erosion within the Valley during Retirement of the Glacier.—The staircase left by the ice, with its rock-basin lakes high up in the valley and its morainal lakes in the lower reaches, undergoes a rapid transformation under the influence of running water so soon as the ice has largely vacated the valley. Flowing from the waning remnant of the glacier, this water is overburdened with sediment. Its current is sluggish on the treads of the steps, but develops a cascade over the cliffs between. The coarser *débris* which it carries is thus quickly dropped upon the treads to fill the lake-basins, and with the aid of the finer material, the rock obstructions are cut through in narrow cañons and with a marvellous rapidity. Where a barrier of more resistant rock has hemmed in a portion of the valley (*Riegel*), narrow picturesque gorges have been cut, such as the *Aarschlucht* and the gorge of the Gorner.* The lateral moraines, having slid down their slopes with the retirement of the ice, are rapidly buried under the talus of the rock-slides from the steep valley walls, thus partially obscuring the characteristic U of the valley section. Sufficiently clear marks are left, however, so that there is seldom serious difficulty in restoring the main outlines of the glacial history of the district.

* Some of the Swiss gorges were described by Tyndall ('Hours of Exercise in the Alps,' pp. 224–230).

A TOUR IN THE LIBERIAN HINTERLAND.

By Captain BRAITHWAITE WALLIS, F.G.S., F.R.G.S., His Majesty's Consul-General at Dakar, lately H.M.'s Consul-General for Liberia.

In the early part of 1908, having completed some pressing work at Monrovia, I made arrangements for an official tour in the interior of Liberia. The route lay from Monrovia to Sierra Leone by steamer (some 250 miles); from Freetown by railway to Baiama (some 220 miles), which place is within a few hours' march of the Anglo-Liberian frontier; and from this point on the boundary to march eastwards.

On April 18, 1908, I left Freetown by railway, reaching Baiama, near the frontier, on April 20. The following day I marched to Bariwalla, which, by looking at the map, will be observed to be within a short distance of the boundary. The caravan was made up as follows: twenty-five carriers with one head man, one head interpreter, one second interpreter, one cook, two personal servants, and one guide. Our battery consisted of three Lee-Enfield carbines and one pocket revolver.

On April 23, after crossing the frontier, we arrived at Vahun, in the Guma country, where we halted for the night. This part of Liberia is hilly, and the paths (there are no roads) are exceedingly bad. The forests, eating close into the scattered villages, appear gigantic and dense, and are inhabited by herds of elephants. On April 27, after a long march over the Kambui range, through swamps and along narrow tracks, we arrived at Kamatahun. The Kambui range divides the Mende from the Bande countries, and is a straggling group of wild, rugged, and forest-clad mountains. Baboons, leopards, the small leopard cat, and other animals abound in this forest; and the hills and gigantic rocks, with their caves and crevices, are believed by the natives to contain good and bad spirits. The place, in consequence, is regarded by them with suspicion and dread. The geological formation, to a great extent, consists of laterite, diorite, and ironstone. The latter, in places, caused me some trouble on account of the magnetic attraction, and the consequent erratic behaviour of the compass. The next day the caravan reached Sambatahun, and on April 30 we arrived at another Bande town, called Zigizu.

On the following day we arrived at Janne, in the Gorahun chiefdom of the Bande country. Here the paramount chief resides, and by him we were well received. He complained bitterly about "the war," with which, he stated, his towns and people were constantly being threatened. He spoke about the large war-town of Pandeme, in the Bunde country, which, he said, harboured thousands of fighting men known as Sofas. This place is a terror to the surrounding country, and is believed by the natives to be impregnable. It is supposed to be guarded by spirits,

* Map, p. 356.

and to possess a very powerful devil, who always renders victory assured, either in attack or defence, to the warlike inhabitants.

Pandeme, encircled by trees, is situated in more or less open country in a hollow, and is surrounded by hills, a splendid object for artillery fire. It is protected by many strong stockades, and within their walls live some of the greatest cut-throats in West Africa. All kinds of savage and barbarous customs take place in Pandeme. Life is held to be cheap there, as it often is in barbaric Africa, and human sacrifices are enacted. Large quantities of slaves are bought and sold. In fact, the object of most of the raids and the attacks of the Sofa warriors was the capture of slaves, and these forages extend over wide areas of country. Although Pandeme is within the tribal boundary of Bundeland, it belongs to no exclusive clan or tribe. It is likely that representatives of most of the people within the Liberian hinterland and adjacent territories live, or have lived there, either as fighting men or as captured slaves. Sofa is a native word meaning a collection of different peoples. The town seems to have been in existence and flourished for many generations; and tradition has it that it was noted as a war centre before the great-grandfather of Samore or Samadu was born, that celebrated Muhammadan warrior who gave the French such a lot of trouble in the Sudan. Samadu was, it may be remembered, captured unexpectedly by a small French column in the Liberian hinterland.

No white man seems to have ever visited Pandeme except Mr. T. J. Alldridge, I.S.O.,* who did so at some risk in 1898, when he was Travelling Commissioner in Sierra Leone. He was then engaged in making Treaties for the British Government with the various chiefs in the territories that, since August, 1896, have become part of the Protectorate of Sierra Leone. Pandeme was the limit of Alldridge's tour. In the journey described here, I passed close to it, but being pressed for time, I pushed on north-eastward towards Central Liberia, and then turned northwards to the French frontier.

The population of Janne is large, almost untouched by the so-called civilization on the coast. It is typical of Western Africa. The men, who are nearly all of the Bande (Gbandi) tribe, have fine physique and very black skins, and most of them plait their hair, which is worn about 6 inches to 8 inches long. They appeared to be well armed with rifles, guns, spears, and swords. While in this town I saw seven slaves, who were secured by the leg in wooden "stocks." They had been in that position for some months. One of them told me through the interpreter that he had been kept thus for two years. He was a man of poor physique, and a purchaser could not therefore be easily found for him. Throughout this hinterland, as has been before stated, slavery in its worst form is in a flourishing state, and one becomes painfully aware of

* See 'The Sherbro and its Hinterland,' by T. J. Alldridge.

the incongruity of the name "Liberia" when such scenes as these are met with. Nothing would have given me greater pleasure, just then, than to have cut these poor creatures' bonds and set them free, but I was, alas! powerless to act.

That night, while asleep in my little hut in the town, I was awakened by hearing a gentle chorus of women's voices singing some yards away. After a few minutes the chorus ceased, and a single voice began, in Bande, an African song. The voice was soft and melodious, and the tune was fascinating and weird, and harmonised with the wild environment to which it belonged. After a few lines, the other singers joined, and the result was most attractive and beautiful, containing as it did such delicate harmony with excellent taste. During the years I have been in Africa, I do not remember having heard anything quite like this singing before, and I shall never forget it. The interpreter told me the next morning that the song was to the good spirits, asking them to guard and protect the white man and his followers on their journey.

On the next day we left to continue the march eastwards, crossing the beautiful upper Lofa river just beyond Janne by a swinging hammock bridge, made of creepers, vines, and wood. This river divided the Gbandi and Bunde countries, for when over the bridge we had entered Bundeland, the place of the warlike Sofas. Owing to the vicinity of these people, the town of Malema, where we halted for the night, was strongly stockaded. There were no less than thirteen formidable war-fences round this town, and the carriers had considerable difficulty in squeezing their loads through the narrow apertures. A few yards outside the first stockade, I noticed an empty grave, the newly turned earth of which showed it had been recently dug. This grave, it appeared, had been used for the purpose of burying a man alive as a sacrifice; and I was informed in a most matter-of-fact way, and as if the occurrence was quite an ordinary one, that the unfortunate victim's body had been lately exhumed to obtain certain portions for the purpose of manufacturing fetish medicines.

The next day proved to be a hard march for the little caravan. Leaving Malema before dawn, we at once entered into a vast forest. Immense trees, creepers, and foliage of all sorts and conditions surrounded us on every side, and locked themselves over our heads, sometimes obliterating nearly all light. Roads there were none, only mere tracks, often not discernible amidst the varied tangles of undergrowth. In places the limbs of great trees and other obstacles lay right across the track, and sometimes even these were crushed and obliterated by the herds of elephant which abound. For these huge beasts, during their roamings, make roads like a carriage drive, scattering heavy obstacles about and uprooting large trees like mere wheat-awns from their sockets. Sometimes the carriers had to hack their way through this dense foliage, and

hew down the tall sharp-edged grass, which bit into the flesh like a knife whenever it came into contact with it. Sometimes they crept under a fallen tree, lying larger than some lightning-smitten oak across their track. At other times they had to disentangle themselves and their burdens from the huge and unyielding creepers, which seemed ever ready and savagely delighted to retard their hard-fought progress.

A large number of natives had gathered to meet us at Bué, which is a big town in the Zembe chiefdom of the Bunde country. It was brought home to one here that this was real Africa, quite untouched by the hand of European intercourse. Not a cloth, nor a spear, nor a sword, that was not of pure African make, was to be seen anywhere, with the exception of the guns and rifles. To the student of Africa, and those who are interested in the study of savage and primitive man, in the wonders of Nature, and in the botany, geography, and zoology of a little-known and unexplored country, the inconvenience of travel and the troubles of the day before were perhaps worth enduring. The fascination of the country steals upon one on such occasions, and the beauty of the wonderful forest and scenery, and the subtle attraction of being with a people who are living natural lives and as Nature so ordained, perhaps touches some dormant spot, which awakens the feeling that the somewhat artificial existence of Western civilization and the striving and the hurrying are not all that we were intended for. In this part of the great Dark Continent, and particularly in Western Africa, with its hidden mysteries and strength, fierce as a furnace and as unrelenting, men's minds dwell upon these things, and they sometimes feel most strongly the subtle fascination of their environment.

There was little or none of the Gbandi language spoken in the place, Bunde being the principal dialect. The town is a large one, and the ordinary wooden war-fence was not in existence. In its place, a high and thick mud and loopholed wall enclosed the town. It was made of a reddish-brown earth, and became very hard after exposure to the sun. The people appeared higher in the scale of African civilization than those in the lower Bande country, for Muhammadanism is finding its way very rapidly into Liberia from the north. The women, who wore their hair long, and decorated themselves with massive silver armlets, were of fine physique and not ugly to look upon. The men were equally fine, and had very black skins. They were, as usual, armed with guns, spears, and swords, and many of them were clothed with handsome cloths and gowns of pure African manufacture.

The forest through which we had passed the day before was, of course, full of many varieties of timber. *Khaya*, a species of mahogany, and the heavy camwood, had been obtained from it by the natives. I saw no teak (*Olfieldia*), although it probably exists in the neighbourhood. Rubber vines were in evidence, and this portion of the great forest probably contains quantities of rubber, as in other parts of Liberia.

Twenty-two different kinds of vines and trees produce rubber of various qualities, and no less than sixteen species of rubber have been classified. The *Funtumia africana* and the *Funtumia elastica* exist in the various belts, and its collection is popular among the Kpwesis, Susus, Beilas, Bundes, Mendes, Golas, Vais, Mandinsos, and other tribes in the Liberian hinterland.

As the rainy season was advancing, and there being little time to spare, we turned northwards and marched for a town called Zigida, which is not far from what has now become the French frontier. The paramount chief of the whole of this part of the Bunde country was then staying at this place, having been driven out of one of his towns further north by the French, with whom his fighting men had come in contact.

It was there that poor Doctor Voltz, the plucky Swiss explorer, was killed in 1906, during an attack by a French column. How the doctor actually met his death will probably never be known. Whether he was killed by the natives, or whether he fell a victim to some stray French bullet during the attack, there seems no evidence to show.

On May 7 we left in a north-easterly direction for a town called Barwoi. We had now entered the Buse country, and at this town we camped for the night. I had now to decide whether it would be advisable to risk journeying eastward and more or less parallel to the route we had already taken; or whether to proceed north-east to the nearest French outpost, which happened to be some six hours' march away. Hearing a report about an impending attack planned by the Buse people upon this outpost, this finally decided me to make for Sondeme, and warn the French of this proposed attack. On May 8 we reached the French post, and I was most cordially received by the acting commandant and other officers at this wild station. The French detachment only arrived in January, 1908, and had already done excellent work in building barracks and clearing the ground. A company of one hundred and five men, in command of a captain and two lieutenants, was stationed at the post. The other outposts, from west to east, were, Wulade,* Goueckedu, N'Zebala, and Gouke. (The spelling is French.)

The French officials could, however, tell me nothing about the country through which I wanted to pass, nor about its inhabitants, nor the routes. No European, nor, it appears, any "civilized" native (*i.e.* one wearing trousers and boots), seems to have passed through the country in the direction I wanted to go. The French officers thought it would be safe. I was anxious to go that way, as nobody else had. It was a more direct route to the British frontier, and would make a useful traverse, if the times and bearings could be correctly taken and

* At present occupied by a British force.

recorded. On May 10 the caravan started off for Barkame, in the Toma chiefdom of the Northern Bunde country, at which place it arrived after a 7½ hours' journey. The natives appeared a savage-looking lot, and all armed.

On the 11th we started off for a town called Koinjama. This place is in the Barru chiefdom of the Bunde country. Crowds of armed and savage men turned out to meet us on the road, but nearly everywhere, up to the present, we had been fairly well received. On May 12 we continued the westward journey. But from now onwards our difficulties commenced, for the little caravan had unwittingly entered into hostile territory. The young chief of Barkame, who had accompanied us to Koinjame, changed the guide at the latter town. About half an hour from a large town called Betiema, in the Barru country, the carriers were prevented by armed natives from entering and passing through a small village, which was about a quarter of a mile in front of another large town. Our new guide appeared to be very angry at this, and having found the headman, the headman stated that he had no power to allow strangers to pass through his village, adding that it was against the law of the country, and could not be permitted. He, however, volunteered to show us a way round. We were therefore led by a circuitous route over bad country where no paths existed, for about an hour, by which time the caravan had made a large semi-circular *détour* round the village and the large town at the back of it. The guide, who was accompanied by his brother, then asked me to wait while he went back to find and interview the chief, ascertain the cause of the trouble, and obtain a guide to show us on to the next country. We waited and waited, until two hours had passed, but no guide appeared. Meanwhile crowds of scowling and angry-looking armed men were collecting round us, and in the bush on either flank.

My Muhammadan interpreter whispered in my ear that matters were looking very serious, when the guide's brother, who had remained with me, volunteered to go back to the town, less than half a mile away, to ascertain the cause of the delay. He suggested that we should proceed on to another small village about a couple of miles off, and there await him. This I did, the crowds of savages closing in upon our front, flank, and rear. They were very hostile and quite ready to murder us, and we knew afterwards that they were only awaiting the orders of their chief.

For a time our lives were trembling in the balance, when an old woman called out something in a shrill voice from the village, and the tension seemed to break. The crisis for the time being had passed. After a great deal of talk amongst themselves, the headman called a native and ordered him to "show the white man the road." There was some temporary relief in this, but more trouble was ahead of us. The new guide only agreed to go as far as the next village, where, he

stated, their boundary ended. Here, the same thing happened. We were surrounded by hostile and savage people, and I was compelled again to talk to them, and at last succeeded in obtaining another temporary guide. For the remainder of the day we pushed on, travelling along winding narrow paths and over fallen trees and other obstacles. The roads, or rather tracks, were awful, the vegetation and foliage resisting, the environment depressing, and all the time we were being followed and threatened. I was, nevertheless, able to take and read the time and bearings, and note them down in the field-book.

By 6 p.m. we were within about a quarter of a mile from a place called Mumusa, when we were again stopped by more armed natives, who told us that there was "no road," and that we could not pass. The interpreter asked the way round, but he was told there was none. After a great deal of talk, a native volunteered to inquire of the head-man whether we could pass, and after waiting for some twenty minutes we were allowed to enter the town. At this place I asked the chief to give shelter for the carriers, staff, and self, telling him that we were tired and hungry, and had journeyed many miles. He refused, and as the place was full of hostile-looking people, I decided to push on to the next large town, called Kwalahun, in the Taramba chiefdom of the upper Bande country.

It had by this time become nearly dark, and we were again met outside the town by crowds of men, who refused us admission. The noise they were making was deafening, and the place was rapidly filling, for some of our friends at the former villages had followed us, and joined in with the others. As we could again neither go on nor turn back, I decided to sleep, or rather rest, in the adjoining forest, trusting that no attack would be made upon us during the night. Just as the weary and frightened carriers were preparing to light a fire, a brother of the chief of the Taramba country turned up, and after a deal of talk offered to take us to a place on the top of a neighbouring hill, which consisted of one small hut and two sheds, and where, he informed us, we could spend the night. This offer I accepted, and weary, hungry, footsore, and absolutely worn out, we dragged our limbs to the proffered shelter, through the inky darkness, and along a narrow winding path, not knowing whether we were to be treacherously murdered at any moment. Here we remained for the night, but sleep was out of the question, because we had all to be on guard.

At 2 a.m. in the morning, a messenger arrived to say that the paramount chief of the Taramba country, who lived at another town, had sent orders to the people of Kwalahun to allow us to sleep in the town. This I refused to do, but told the messenger that I had decided to enter the place at dawn. It is advisable to show a bold front to these people on such occasions, even although one's battery consists of only three carbines and a pocket revolver. At about 6 a.m., therefore, we

entered the town, which was packed to overflowing with a hideous and wild-looking lot of armed savages. Into the middle of this crowd we went, the carriers sitting on their loads, and myself resting on a small stool in the midst of them, with the interpreter and servants standing behind. Many questions were asked by the speaker on behalf of the Chief as to our object in coming into the country, where we had come from, etc., etc. Any untoward incident, such as the firing of a gun, would have acted like a spark, and I was perfectly aware that our lives hung on my answers and upon the behaviour of the poor carriers, servants, and interpreter.

Most of the carriers behaved splendidly, and my Muhammadan interpretor was simply superb. Soon after I had finished talking to the natives, a very fortunate and rather extraordinary thing happened. A tall Muhammadan priest, clothed in white robes, walked right into the midst of the people and came up to me. He was an old friend whose acquaintance I had made some years before at Bariwala, on the frontier. Being ignorant as to how matters would go at the meeting, and not knowing whether we were to be killed or not, he had been afraid to show himself before, and had remained hidden in the town. As soon as he had greeted me and some of the other members of the caravan, he addressed the chief and people, stating that he had known me before, and adding by way of encouragement, that I was "a good white man for the black." He suggested that he should accompany us to the town of the paramount chief, which was a few hours away. This was finally agreed to, so we started off for the place, called Singbalahun, where we arrived at 12.15 p.m. Here the paramount chief of the Taramba country, an old white-haired man, with an evil though shrewd countenance, was waiting to receive us.

The place was as usual crammed with people, and it looked as if the whole male population from the neighbouring towns and surrounding country had come in to see us. I talked to the chief, explaining our mission through the interpreter. After a great deal of talk, he told me that the country was disturbed owing to the fighting with the French, and to the doings of the Liberian Government at and about Kanre Lahun, and in other parts. He said that it was for this reason, with others, that the people did not want to see any civilized person, black or white, in the country. He added that the white man and the "civilized" black man did no good when in contact with the people, and could not understand their ancient laws and customs. Also that after a time the people became demoralized and their women folk debased; that their "boys" and domestic slaves ran away, wore the white man's clothes, and returned to despise their fathers. Also that the black soldiers, dressed in Government uniform, plundered and terrorized the people whenever they could, and outraged their women.

After this remarkable speech, the old chief, who had spoken more

like a statesman in a civilized country than as a barbarian in savage Africa, ended by saying that he did not understand how we had managed to get here, and that he would go and consult the other chiefs and elders of the country, who had already arrived in the place. Meanwhile streams of fighting-men had crossed the Makona river to the north, and were arriving every minute. Large numbers of these people were Kisis, who had been giving the British Government a good deal of trouble on the Anglo-Liberian frontier. Their chief, Kafura, had sworn to cover his war-drum with the skin of a white man. So now, they probably thought, was a rare opportunity to get the parchment. A number of the chief's subjects and the Kisis demanded that the white man and his speakers (interpreters) should be killed, but that the carriers should be taken as slaves. After long arguments, much talk, and discussion, the old chief eventually had his way, by offering to pay, according to the law of the country, a large sum of money to the medicine men, in order to induce them to annul the powers of the fetish from an infraction of the oath, or, literally interpreted, to "pull the swear." The fetish doctors, who had charge of the "medicines" upon which the oaths had been taken, were recognized in having this power, for under certain conditions they could remove the effects of the oath by some supposed magic means and ceremony. The old chief was anxious, not for our lives (about which he probably cared little), but to avoid the responsibility and probable consequences, of having us killed within the borders of his own jurisdiction. At the end of the meeting, the chief suggested that we should remain in his town that day, adding that it would be necessary to send his messengers to the neighbouring chiefs to ask them to allow us to pass through the country unmolested. These chiefs had doubtless been a party to the oath also. I agreed, there being no other course open, to remain in the town for that night, and gave orders for the march of the caravan at dawn the next morning.

The chief put in an appearance about 6 a.m., and asked me to remain until the afternoon, adding that he wanted to send more messengers. The first lot had returned, but the answer they brought back did not appear to be satisfactory. Fearing treachery, I refused to remain; and after a lot of talk, and being greatly assisted by our Muhammadan friend the priest, the chief agreed to lend us his principal messenger as a guide. Calling this man, he handed to him his own sword, and ordered him to show us along a little frequented path, by following which the numerous and doubtless hostile towns along the route would be avoided. Consequently, on May 10 the little caravan started off once more, being still accompanied by the Muhammadan priest. We sped along through rough hilly country. There were, of course, no roads, only mere tracks, sometimes difficult to discern, while the giant foliage and huge creepers swinging overhead checked us as usual on

the way and distressed the carriers. We passed deserted villages. Big farms and cultivation, showing an industrious people and a populous territory, were frequently met with. The carriers required no urging on the way, for after their experience, and fearing a repetition of recent events, they sped fast and almost frantically along. Now and then a black and armed figure, as still and silent as a statue, would be seen gazing at the column from afar.

For hours the energy of pressing the pace, so far as the state of the paths would allow, neither slackened nor varied. At exactly 2.45 we crossed the tribal boundary into friendly country, and a great shout went up from the caravan, who realized that their troubles were over. Shortly after this we entered Massabalahun, in the lower Bande country, feeling and looking, after the recent experiences, a very worn-out and battered party. We had therefore got through this hostile and inhospitable country, practically unarmed and without mishap or bloodshed. Of course I had no idea, nor had the French officers on the frontier, that we were going to plunge into such a hornets' nest.

Little or nothing was known about that part of the hinterland. No European, the people declared, had ever passed through it before. The natives had never been conquered, and consequently knew little or nothing about the strength of the British and French Governments. During the whole of this tour I succeeded in taking the times and bearings of the route, and noted them down. Our lives were spared by great good fortune, due to a large extent to the faithful interpreter, the behaviour of the carriers, and to the kind offices of our Muhammadan friend, the priest.

The following day we reached Bandewuru, in the Tunkia chiefdom of the Kisi country. At 6 a.m. on May 16 we marched to Yandehun, in the Bombare country, which, although in Liberian territory, is at present policed by the British. The following morning we started off for Pendembu, in the Sierra Leone Protectorate. We crossed the frontier into British territory, and left behind us what might indeed be called "darkest Liberia," at precisely 10.50 a.m., entering Pandembu at precisely 2.25 p.m. on May 17, 1908. On May 18 we marched once more for Baiima, at the railhead, where we arrived worn out. That same afternoon I paid off the carriers and staff, giving the interpreters a good deal extra from myself in appreciation of their services.

Although this tour was a flying and very tiny one (almost infinitesimal in the world of travel), being hurriedly carried out between pressing work at Monrovia and the rainy season, some information was gathered about the geography and geology of that part of the interior, its inhabitants, and its potentialities. A large part of the Liberian hinterland consists of a populous territory, rich in indigenous products, and inhabited by numbers of vigorous, powerful, and warlike tribes, whose principal occupation, as before stated, consists in the selling,

buying, and capture of slaves. These unhappy creatures are, as a rule, seized during a raid, and become the property of the conquerors. The indigenes know and care little about the Americo-Liberians on the coast, and when they do come in contact with them, their presence is only tolerated by the chiefs because they give guns, powder, and liquor, and make no attempt to interfere with slavery.

It seems deplorable that the indigenous wealth of the country is being lost year by year owing to the prevailing conditions. Apart from the commercial aspect, the country is full of interest to those who would explore away from its seaboard with note-book, pencil, and camera. Much of the history of Liberia is necessarily bound up in her frontiers; for even in this little-known part of Africa they have played, and are playing, an important *rôle* in her history, even as frontiers play their part in the life and history of other and greater nations.

PROJECT OF A DANISH EXPEDITION TO THE CENTRAL ESKIMO.

By KNUD RASMUSSEN.

It is, I think, universally acknowledged that the study of the Eskimo is a natural task for Danish men of science. For more than two centuries Denmark has held the fate of the West Greenland Eskimo in her hands, and literary and scientific work done by Danish men has resulted in modifying the views held by the civilized world regarding the culture of the Eskimo. In recent years our knowledge of the areas inhabited by the Eskimo in present and past times has been steadily nearing its completion. We know that the Eskimo have lived nearly everywhere along the shores of Greenland, and we now are brought face to face with the problem—from where and along which routes did the Eskimo migrate into Greenland?

Geographical and ethnographical facts prove beyond a doubt that the Eskimo territory at Smith sound and Cape York must be looked upon as the first station along the marching line of the Eskimo on their migration into Greenland. Apart from this one point, however, we know very little, and numerous questions bearing a more or less direct relation to this point are still awaiting their further solution. Partly as a member of the first Greenland expedition of the late Mylius-Erichsen, partly travelling on my own accord, I have, since 1902, chiefly occupied myself with the study of the Cape York tribe, and among them, as well as among the other Greenlanders, I have collected a very considerable ethnological and ethnographical material. In my travels, as well as during my stay among the Eskimo generally, I have profited largely by the fact that I myself was born and spent

my early years in North Greenland, so that I am fully familiar with Eskimo life, and the peculiar way of travelling in Eskimo countries. Through my mother I further descend from Eskimo ancestors, and I speak the Eskimo language as my native tongue, all of which circumstances have helped me, as though I were one of their own, to win the confidence of the Eskimo, thus enjoying an unusual opportunity of penetrating into their contemplative life, their religious ideas—in short, the whole of their intimate life and culture. In consideration of all this, I look upon it as a sort of vocation to try to find a solution of the above-mentioned problems as to the immigration of the Eskimo into Greenland in connection with the general study of the American Eskimo tribes.

Among the Greenland Polar-Eskimo at Smith sound I have been so lucky as to meet a number of families who must be looked upon as being the last immigrants from the American Eskimo districts, and though through conversation with these immigrants I have not been able to establish where exactly they had their native country, among other things because the men who made and directed the voyage are dead, while those who are now alive only took part in it as small children, I look upon it as all but settled that the country from where they immigrated must be sought about the north-western interior of Baffin's Land: that is to say, in the sea inside Bylot island, as well as along the Fury and Hecla straits, in which two territories the population along inland routes which are till now unknown to us seem to have been in close communication with one another.

These inhabitants of the north-western Baffin's Land are, however, very little known, and, at any rate, have never been subjected to a thorough ethnographical study. The Baffinlanders, found and studied by Franz Boas in the Cumberland sound towards the south-east, live so far from the inhabitants of the north-western Baffin's Land, and under such widely different conditions of life that it is impossible to make any comparison between those two groups. Upon the whole, the Eskimo in the north-western Baffin's Land are among the most unknown of the Eskimo people, though this district must naturally be looked upon as the very thoroughfare from the American continent to Greenland.

It is further known that the Eskimo at the Fury and the Hecla straits are closely connected with and related to the Eskimo inhabiting the southern part of the Melville peninsula, or the districts round Lyon inlet, Repulse bay, and Wager river. These Eskimo are likewise very little known, and have never been properly studied.

Still scantier is our knowledge of the group of Eskimo who now and then visit the shores of Hudson bay, near Chesterfield inlet, but whose chief territory is the inland and the lake groups in the tundra-land (barren grounds) between Hudson bay and Coronation gulf. In

opposition to almost every other Eskimo tribe these Eskimo, who are known by the name of the Kinipetu, are inland dwellers, and, if only for that reason, of the greatest interest.

Among the problems which seem most pressing as regards the latter tribe suffice it to mention their limits of extension in relation to their neighbours, the Tinne-Indians; further, the problem of the number of tribes among the inland Eskimo; as well as the districts of these tribes along each of the lake groups, and finally their means of livelihood during the two principal seasons, summer and winter. Above all, this latter question leads to the problem of the Eskimo culture itself, in that the theory has been set forth (H. P. Steensby, PH.D., 'The Origin of the Eskimo Culture.' Copenhagen, 1905) that the fishing methods used by the inland dwellers on the frozen lakes of Canada have been transformed by the Eskimo along the sea-shore, where they became the well-known methods of seal-hunting from the sea-ice (the Manpok methods, etc.). According to this supposition the Eskimo culture was to have its seat near the hemmed-in seas towards the Arctic archipelago, north of the ice-sea shore of the continent, or, in other words, the districts round Coronation gulf and further east, near King William's Land and the Boothia spit.

The last-mentioned districts were last visited by the Norwegian Gjöa expedition, which from there brought back very valuable ethnographical collections, though it had not been able to carry on a thorough ethnographical study. Even less than their kinsmen at the Boothia spit had the inhabitants of Coronation gulf been brought into contact with Europeans, and consequently they are still more unknown. It may be remarked that their technical culture offers the peculiarity that they make their weapons and utensils out of solid copper from the surrounding districts.

If the above-mentioned theory about the culture of the Eskimo should prove to hold good, we have, perhaps, here in Coronation gulf, one of the points of departure of the immigration of the Eskimo who at last reached the Danish possession, Greenland. And therefore, as for many other reasons, the tribes at Coronation gulf must be included in the researches, the starting-point of which was the problem of the origin and the routes of the immigration of the Greenland Eskimo.

It is to be observed that I intend to carry on my researches on as wide a basis as possible, and study, not only the way in which the various districts obtain their means of livelihood, their technique and utensils, but also, as thoroughly as possible, to collect legends and old social and religious traditions. I have already done a good deal of work in the last-mentioned direction, some of the results of which have been laid down in my book, 'The People of the Polar North' (Kegan Paul, London, 1908). Besides, I have a very extensive collection of material from the whole of Greenland, which material can

only be used to the full, and attain its real value, when supplemented with material for comparison from the American Eskimo tribes.

As a practical solution of the problem, I propose the following :—

The expedition, the official name of which will be "The Danish Ethnographical Expedition to the Central Eskimo," will start from Copenhagen on its own ship in the summer of 1911. The type of ship which I propose to use is the *Göa* type (with a motor), seeing that it has been used with such great success in these very districts. On its way out the expedition will call at Danish West Greenland for sledge-dogs and fur-clothes, which, as far as possible, must be ordered beforehand. From there it will go through the Hudson strait, and after that, by way of the Fox basin, it will try to reach a good winter harbour in the Fury and Hecla straits. With these headquarters as a starting-point, it will be convenient to carry on the above-mentioned studies and sledge-trips in and round north-western Baffin's Land.

In the following summer the expedition will start south, and look out for new winter quarters in the neighbourhood of Chesterfield inlet; only it is very probable that I myself will prefer to make this voyage by sledging along the coast. From these southern winter quarters the expedition will study the inland Eskimo on Barren Grounds, while the ethnographical material, collected and bought from the natives, will be brought on board the ship.

In the following spring part of the crew will lay a depôt, partly consisting of provisions, partly of things for bartering with the Eskimo in Chesterfield inlet, as far as possible towards bottom of the latter, eventually as far as the western side of Baker lake. After this work has been done, the ship will start for a new winter-harbour in the neighbourhood of Repulse bay, at the southern end of the Melville peninsula, while I myself, with the assistance of a couple of Eskimo, possibly using canoes of birch-bark, will bring the depôt as far north towards Coronation gulf as the natural conditions permit.

This work, however, must not prevent me from keeping in constant touch with the Eskimo, so that I can study their inland wanderings, their doings during the summer hunting, and, if possible, make archæological researches. As soon as the lakes and rivers are frozen over, and the snow covers the ground so as to make sledging possible, the expedition will continue the voyage and the freighting of the objects acquired through bartering towards Coronation gulf. Among the Eskimo of that neighbourhood I shall remain until April next year, when I intend to make the last sledge trip along the coast of the continent, visiting the Eskimo tribes which live there.

In the course of the winter the crew will have laid a depôt of provisions for me, in a place agreed upon beforehand, somewhere near the Boothias pit. In June I have to be back in the ship, and with the first breaking up of the ice the expedition will start directly for Copenhagen.

From the above it will appear that the extensive sledge-trips, and the collections which will, it is hoped, be the results of these sledge-trips, must necessarily pre-suppose a ship as the headquarters of the expedition. To manœuvre the boat we must, I think, have a captain, a mate, and three sailors.

Besides, the captain of the ship, together with the mate, must do the necessary cartographical work, which, especially in north-western Baffin's Land, will be very considerable; likewise, they must be able to make the meteorological observations.

Seeing that the route followed by the ship-expedition, also in other respects, will offer very interesting, hitherto unsolved scientific problems, the staff will further include a geologist and a physician who, together with the geologist, will be able to undertake the botanical and zoological studies if necessary, also to do the work of an anthropologist and archæologist. Chiefly as regards the study of glacial geology the districts round the projected winter harbours are of the greatest interest, and offer the possibility of making important comparison with the natural conditions found in Greenland. In northern Baffin's Land the glacial formations, the extension and nature of which are hitherto unknown, as well as the Quartiary formations in connection with the glacier, will offer an instructive transitionary stage between the totally ice-covered district of Greenland and the Barren Ground, now free from ice, but in former days covered with glaciers. In Baffin's Land and the Melville peninsula there is also the prospect of carrying on important palæontologic studies, while the Barren Grounds to the west of Hudson bay, which, geologically, are hitherto known through a few hasty visits from Canadian geologists, are furthermore of the special interest that the great American glacial period probably originated in these districts, for which reason researches carried on here offer the possibility for solving a series of problems as to the motion of the ice.

From a geographical point of view, the regions in question are, generally speaking, so unknown that every increase of our knowledge will be of the greatest value, and the expedition therefore ought to profit by the opportunity of making studies and collections in various directions, provided that this work does not throw obstacles in the way of the chief purpose of the expedition—the ethnographical researches.

NOTES ON DETERMINATION OF POSITION NEAR THE POLES.*

By ARTHUR R. HINKS, Royal Geographical Society Lecturer in Surveying and Cartography, Cambridge University.

The writer is fully conscious of the fact that in the severe conditions of polar travel it is not a question of what observations might with advantage be made, but of what can actually be done. The only purpose of these notes can be to

* Research Department, November 18, 1910.

provide a few pegs upon which those who have experience of polar observation are invited to hang the results of their experience.

Published accounts of the details of polar observation are scanty. By far the most complete is Prof. Geelmuyden's discussion of the astronomical results of Nansen's expedition ('Scientific Results,' vol. 2). But these refer, in great part, to a special case—the winter drift of the *Fram*. Star navigation of winter quarters is altogether exceptional. We will confine ourselves for the present to the case of sledging equipment and sights to the Sun only.

The points for discussion may be grouped under three heads—

(1) The instrumental equipment and methods.

(2) The chronometers or watches.

(3) The reduction of the observations.

(1) The principal question is, Theodolite or Sextant? Recent experience seems all in favour of the small "mountain" theodolite, as used by Captain Scott and Sir Ernest Shackleton. Its obvious advantage is that by observing on both faces the errors of adjustment are self-eliminated. A recent traveller observed only on one face. But if, owing to severity of cold or want of time, the double observation is awkward, observations on alternate days should be made on alternate faces. The stand for the theodolite is of importance. Nansen used a brass plate bedded on snow, and lay down. But this must be uncomfortable, and it will be interesting to hear the experience of Antarctic observers. No account of the *Discovery's* theodolite has been published. What was it made of? Nansen found aluminium very unsatisfactory.

The sextant and artificial horizon together weigh little less than the theodolite. The sextant was found by Nansen to be unreliable in extreme cold; very probably it developed error of eccentricity, which is very difficult to determine. And observation of a low sun with an artificial horizon is always difficult. Mercury horizons are liable to freeze; glass horizons do not seem to give satisfactory results. Occasionally it is possible to use a pool of water on the ice; but this must be rare. Some observers have used the natural ice horizon; but this must be very rough and uncertain owing to the piling of the ice; and further, there is a difficulty about the "dip" and the raising of the apparent horizon by abnormal refraction. Geelmuyden gives some interesting results which show that in extreme cold the visible horizon is sometimes elevated by twice the amount that it should be depressed.

Considering all these difficulties, we may conclude that the theodolite is much better than the sextant for taking altitudes. And it is immensely superior in the observation of azimuth. The verdict must therefore be for the theodolite.

It must be important to cover the metal of the instruments as much as possible to protect the hands and face from contact. It would be interesting to learn the details of methods which have been found successful.

(2) On board the *Fram* the chronometer Hohwü 639 maintained an excellent rate, and the uncertainty of G.M.T. probably never exceeded $\pm$ 20^s, though G.M.T. in summer could be checked only by solar eclipses, of which two were observed during the drift. It would be interesting to have full information about the rates of the chronometers on the *Discovery* during her stay in the ice. Chronometers landed for use in observation huts undergo much severer conditions, and Drygalski found it impossible to keep his chronometer going in the pendulum hut.

The travelling rates of watches differ, of course, considerably from their stationary rates; on the *Fram* sledge expedition, the mean rate of two watches differed 12^s per day from the rate on board. The slight information given by Lieut. Mulock (National Antarctic Expedition, 1901–1904, Charts) suggests that the watches on the *Discovery* sledge journeys ran better, but details are wanting.

(3) The correction for refraction is important and difficult. Geelmuyden used Albrecht's tables, founded on Bessel's and extended to −50° C. by his formula. He gives observations of very low altitudes made expressly to determine refraction, but does not discuss them. Mulock used Bessel's tables, but gives no details of his extension of the tables for low temperatures.

Very little information is available as to the accuracy of the sights obtainable under Arctic conditions. The writer would urge that it is important that full details of all the observations made on recent expeditions should be published, in order to provide material for the discussion of their accuracy. Astronomers have an invariable rule, to publish their observations in such detail that it may be possible to assign limits of probable error to the results. The same rule might very well be observed in the publication of the results of polar expeditions. This remark need not be taken to imply an expectation of impossible refinement in observations made under rough conditions. But at present it is difficult to say whether the probable error of a "fix" with the mountain theodolite on a sledge expedition is one mile or two or five. And this might be remedied at once by full publication of the observations.

Near the poles the ordinary methods of determining position fail to some extent. Local time and longitude tend to become indeterminate, and this gives the impression that there are great uncertainties in the "fix." To a considerable extent this difficulty is artificial, and by a suitable modification of the methods of reduction employed may be avoided. The writer suggests that a modified Sumner method will give a rapid and easy graphical method of discussing polar observations. [A brief account of the method is appended. It is being developed, and a fuller account will be published later.] The method is suggested, in the first instance, as a convenient way of examining a long series of records. But it is possible that it may be of use on an actual expedition.

Incidentally the method shows very clearly that the accuracy of the "fix" depends entirely upon the accuracy of the "sight" and the accuracy of the G.M.T. carried by the watches. So long as pairs of observations can be secured on considerably different true bearings of the sun, it is comparatively unimportant at what time of day the observations are made; there is no real necessity to interrupt the journey at local noon; and the apparent difficulties connected with local time and longitude disappear.

Graphical Method of Reducing Polar Observations.

Take a polar chart, with parallels numbered in degrees of polar distance, and meridians numbered in hours from Greenwich.

Suppose two sights—

A at G.M.T.	$14^h\ 29^m$	alt. of sun	18° 20′	decl.	13° 46′
B „	$20^h\ 47^m$	„	14° 12′	„	13° 50′

Reduce to G.A.T. and lay off meridians in the corresponding azimuths.

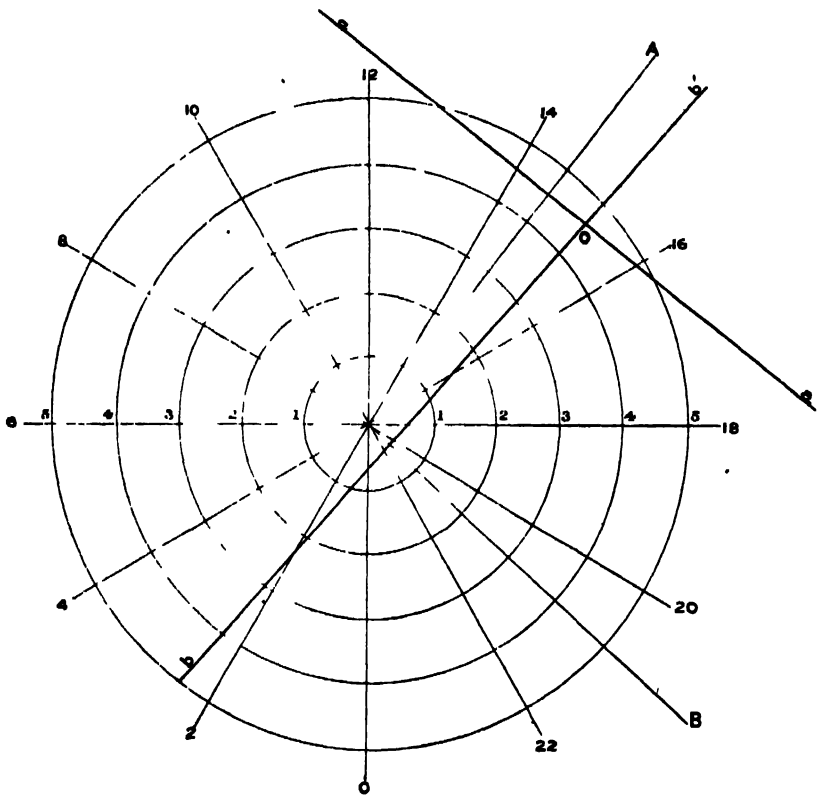
At first observation Sun is on meridian A. The circle of equal altitude 18° 20′ cuts this meridian at polar distance = altitude − declination = 4° 34′. The line aa' at right angles is an approximation to the circle of equal altitude, and the observer must be near it.

Similarly construct the perpendicular bb' to meridian B, cutting it at polar distance (14° 12′ − 13° 50′) = 0° 22′. The observer must also be near this line. Hence his position must be near the intersection O. The method is evidently a modification of Sumner's.

The circles of equal altitude are necessarily very large, as the Sun is always low. They lie on the Sun side of the approximate Sumner lines drawn. In the present case the circles would evidently intersect outside O, close to the line *aa'* and a little removed from *bb'* towards *a'*. Within 5° of the Pole the correction for curvature of the Sumner lines does not exceed about 3'. Hence the method gives a rapid way of checking a whole series of observations made on any bearings. Perhaps it is well known. The writer has not come across it.

Incidentally it shows that two sights on well separated bearings give as good a fix close to the Pole as anywhere else. The apparent trouble about the indefinite-

QUICK METHOD OF DETERMINING APPROXIMATE POSITIONS.



ness of local time and longitude is artificial, due to use of unsuitable co-ordinates. A little extra trouble will make the method sufficiently accurate for all purposes. Use a polar stereographic projection, which is practically the same as the polar equidistant close to the Pole. Then the circle of equal altitude becomes a circle on the projection. It is easy to calculate its radius on the projection, and hence its divergence from the tangent at any distance from the point of contact. It would then be easy to make the fix graphically within 1'.

Small tables to give the curvature correction are under construction.

The method has all the advantages of Sumner's or Johnson's. Sights may be made at convenient opportunities, not necessarily at local noon. The only table

required is that of the Sun's declination. Within 5° of the Pole the sights may be worked up graphically in a couple of minutes with all required precision. The method is suggested, in the first instance, as a convenient way of examining a long series of records. But it is possible that it may be of use on an actual expedition.

Dr. STRAHAN (before the paper): The paper for this afternoon is on the Methods of taking Observations in the Polar Regions, by Mr. Arthur Hinks. It is unnecessary for me, in view of recent events, to enlarge upon the importance of an observer being able to ascertain his position when he is approaching the Pole. The difficulties of doing it are sufficiently obvious to any one who has glanced at the summary of Mr. Hinks' paper.

Dr. STRAHAN (after the paper): We have among us several distinguished cartographers from different parts of the world. We should be very pleased to hear any remarks on the subject from them.

The following letter was read from Admiral Sir ALBERT H. MARKHAM: Speaking from my own experience while sledging northwards over what we called the Palæocrystic sea, I am inclined to say that when a high latitude has been reached by a traveller, whose object is the attainment of a still higher latitude, no matter in which hemisphere, there are only two observations to be taken that are of any real importance in order to enable him to determine his position. These are for latitude, and those for ascertaining the variation of the compass. The latter is of great importance, for it enables the traveller to steer a straight and direct course towards the Pole. Observations for longitude are therefore unimportant supposing, of course, that your departure has been made from a base, whose latitude and longitude have both been ascertained before leaving. When I was sledging north, I never bothered my head about taking any observations for determining my longitude, but I was very careful to check my course by constant observations for the variation of the compass, thus enabling me to shape my course along the same meridian of longitude.

The only other observations that I took were those for latitude, and these were obtained by observing daily the meridian altitude of the sun, either at noon or midnight, whichever was the most convenient, and, of course, when weather conditions permitted me to do so. The taking of these apparently simple observations was not quite so easy as might be imagined. Even at the latitude that I reached, which was just beyond the 83rd parallel, I found it an extremely difficult matter, with a mercurial artificial horizon (constructed specially for use in high latitudes), to obtain reliable observations when the altitude of the sun was very low—as it was at midnight—for it was not an easy matter to bring the two suns, the true sun and the reflected one, into the artificial horizon, so as to obtain a proper contact with the lower and upper limbs. Then it must not be forgotten that the difficulties which were experienced by me in the neighbourhood of the 83rd parallel, and during the months of May and June, would be very materially augmented in a higher latitude, and would be doubly intensified at an earlier period of the year, say in April!

I am of opinion that during that particular month, it would be almost impossible, in a high latitude, to obtain the meridian altitude of the sun with the ordinary mercurial artificial horizon, even if the mercury was in an unfrozen state, and I know of no other practicable horizon that could be used so as to obtain an accurate observation.

I have no faith in a glass horizon; the difficulty of adjusting it, so as to make it perfectly horizontal by means of spirit-levels and thumbscrews in a temperature 30° or 40° below zero, would be enormous, especially when placed on

snow or ice. Oil or water horizons would be useless in low temperatures. I know nothing more aggravating than taking the meridian altitude of the sun in a high latitude; for its actual passage of the meridian is practically inappreciable, and it is most difficult to determine when the sun has actually ceased to rise and has commenced to dip! It is almost impossible for an observer to decide for at least thirty or forty minutes when the sun has passed the meridian!

I have had no practical experience of the use of a theodolite, but I am inclined to think it would be a better and more useful instrument than a sextant. No observations taken with an "ice horizon" would, in my opinion, be of any value.

Until recently I have never heard of chronometers forming part of a sledge equipment. In the first place, they would never stand the extreme cold to which they would be exposed, nor would they be improved by the rough usage which they would be subjected to on a sledge. I certainly would put no trust to their rate after being on a sledge for a few hours! In the expedition of Captain Nares, each officer in charge of a sledge was supplied with a chronometer watch, which he wore in a little pocket on the vest next to his skin, but nearly all these watches stopped, in consequence of the slight amount of oil, by which the works were lubricated, freezing. Finally, I should say that the more simple and the fewer observations, compatible with determining your position, the better. I have no reliance in positions determined by dead reckoning alone. I know on occasions when I was unable, from thick weather or snowstorms, to obtain observations of the sun for perhaps four or five consecutive days, I had to estimate the distance I travelled by various methods, and I always endeavoured to underestimate the distance, so that I should not be greatly disappointed when I was enabled to fix my position. I may say I was *always* disappointed, for I invariably found I had overestimated the distance travelled.

Sir Lewis Beaumont: I have no doubt we shall hear later the practical experience of officers who have taken part in recent expeditions. I can only speak of the one which has been described by Admiral Markham, but there are one or two points in connection with it which I think it is worth while remembering. The expedition of 1875 was the last offspring of the great Franklin Search. It was fitted out by the officers, who themselves had taken part in that search, in the way which they looked upon as the very best. As you may remember, it was based on man-hauled sledges only, which has never been done since. That shows that it is hardly worth while going back to the expedition of 1875 for the purposes of making comparisons with later ones, but several points have been mentioned by the lecturer upon which I can give a little information. For instance, our expedition only used sextants, and the reason was that in the outfit everything was cut down to the very narrowest margin of weight, so that a heavier instrument, such as a theodolite, was rejected for the sextant. All exposed parts of the metal were covered with chamois leather, so that the inconvenience of touching them with your bare hand or face was removed. It must be remembered that in the expedition I am speaking of, it was not considered possible to travel in the winter, consequently the sun was higher during the long sledge journeys, and there was not the same difficulty in obtaining sights which winter travelling involves. There was no difficulty about the mercurial horizon either as to extreme cold or low altitudes.

We may look upon it that expeditions to the North Pole are practically finished. Commander Peary has been there, as the American Geographical Society has certified, and it is not likely that anybody else will ever again attempt it; there is Amundsen's expedition, it is true, but that is not for the purpose of reaching any definite point, and they will have no difficulty in fixing their position. There remains the South Pole; it will be very interesting to hear what the experience in the Antarctic is.

If the object is to reach the Pole, we believe now, from Sir Ernest Shackleton's discoveries, that it will be by a continuation of land travelling, and not over moving ice. The travelling, therefore, will be in spring or summer, and so free from some of the difficulties due to low altitudes.

Captain Scott: I wish to say that I heartily agree with the lecturer in considering that such a discussion as this may serve a useful purpose in defining the nature of the evidence which a scientific society such as the R.G.S. considers necessary that a polar explorer should produce to substantiate his discoveries. I regret that I had not sufficient notice of it to communicate with Lieut. Mulock, who had charge of our *Discovery* records; but I should have required a long notice to do so, as Lieut. Mulock is now in China. Speaking generally of the *Discovery* observations, it is to be recalled that observations for position were usually accompanied by bearings of conspicuous landmarks, and in a long series these would naturally form a check on one another. Any considerable error in position would be shown up by the impossibility of fitting in the land bearings taken at the same spot.

In regard to instruments, I am confident that the 3-inch theodolite, such as we used, is in every way more serviceable for polar work than the sextant. The natural horizon both in the north and south is hopelessly erratic from a variety of causes, and the artificial horizon is a clumsy and unstable instrument quite inadequate for the observation of low altitudes. A duplicate of the 3-inch travelling theodolite which we used can no doubt be seen at any time in Carey's shop, in Pall Mall. It is a very handy little instrument, but has certain drawbacks, to which I may briefly refer. I found the tripod unsatisfactory on the Barrier surface, as the legs had to be driven 8 or 9 inches into the snow before any degree of rigidity could be achieved; in some places even this did not suffice, and to get observations I was obliged to wait some hours to allow the tripod to freeze in and thus fix itself. I think this difficulty can be surmounted, and I propose to have flat plates attached to the base of the tripod legs in my future instruments.

Another difficulty arose on account of the contraction of the spirit in the levels; the bubbles became so enlarged in consequence that their limits could not easily be brought within view together. I think it advisable in the future to start with the smallest possible bubble or some device for compensating the contraction of the spirit. Our small theodolite could only be levelled roughly by the base-levels. To obtain accurate levelling it was necessary to adjust by the telescope level, by turning it over two screws or the third in the usual manner. With such small instruments, liable to occasional shocks, it is most important to take observations on "both faces." I will not say I always did so, but if I omitted to do so one day, I was most careful to take the fuller observations the next. A round of angles after chronometer sights was often a tedious and cold business, and I must confess that I often missed the final check which is customary after such a round, that of taking a second bearing of the sun.

With regard to refraction, we were, of course, greatly puzzled as to what tables to use. I am inclined to think the refraction small on the Great Barrier. I may mention that I frequently took meridian altitudes within a few miles, at noon and at midnight, and the difference in position given was never more than 3 or 4 miles. This gave the difference in refraction between a very low sun, 10° or so, and one at a considerable altitude, about 30°. I think it is arguable that if the difference in refraction at these altitudes is so small, the total refraction for either altitude cannot be very great. It is interesting to consider that in very high latitudes a sight at midnight and noon would practically eliminate refraction, and you have thus means of escaping all criticism of observations in this respect. At the pole refraction would not count at all if observations were taken on several bearings.

The lecturer has said that the watches supplied to the *Discovery* Expedition appeared to have been satisfactory. I regret that I cannot endorse that view; the only really good watch we had was that which I am now wearing—the rest were anything but reliable. But it must be remembered that it is asking a great deal of a watch, to expect it to keep an accurate rate under the circumstances under discussion. It is bound to receive occasional shocks; it is in continuous and irregular motion, and subject to considerable differences of temperature. It is remarkable that watches can be made to retain any degree of accuracy under such conditions. It is for this reason that I should deprecate placing too much reliance on any form of Sumner method such as that suggested by the lecturer. I remain a firm believer in the meridian sight, for latitude is, after all, the most important point for the polar explorer to determine. As a purely practical consideration, I might add, also, that the difficulties of handling a chart and fixing positions by drawing lines upon it are greater than those presented by notebook calculations. One can do a lot of calculation in a polar tent with notebook, tables, and pencil, when to spread out a chart and use rulers on it might be most difficult.

I do not think I have anything more to add, except perhaps to point out the ease with which the discoverer of the South Pole should be able to fix his position. Unharassed by the consideration of breaking sea-ice, he would aim at reaching his goal in the middle of the southern summer, when the sun has achieved its maximum altitude. The ideal day would be December 23. The change of declination would then be negligible in twenty-four hours—that is, the sun would revolve about the observer at a constant altitude. One can imagine, as a rough check, tracing the shadow of a vertical stick and finding a complete circle. May I add that I think the lecturer's suggestion that records of positions should be treated like other scientific data and published is a good one.

Sir DAVID GILL: I do not know, from the rather slighting way in which the polar traveller seems to speak of astronomical observations and their importance, that the astronomer very well comes in. I think that the suggestion of Mr. Hinks about the employment of the Sumner method is instructive. The Sumner method is really *the* practical method, for, at the instant of observation, it shows that the traveller must be somewhere on a particular circle on the Earth, and that is all that any single altitude can tell. A similar observation at another instant of time gives another circle on which the observer must be, and the insection of these circles is the traveller's position. Lord Kelvin some years ago gave a simple means for working out Sumner observations. I do not see that the whole of the observations need be completely worked out at the time. The astronomer, when he goes on an expedition, is only careful to collect the observations, and when he gets home he reduces them in the best way he can, and I think that what Mr. Hinks says is right, viz. that if we had access afterwards to those observations, they could be thoroughly discussed so as to give us some idea of the experience of the observers, and what accuracy is obtainable in such circumstances; and, at all events, it would put an end to all questions as to whether a man was or was not there. If we had these observations made in that way, simply a record that we had an altitude at such and such a chronometer time, you have perfect control, and I defy anybody to cook a series of such altitudes as the traveller went along.

Admiral FIELD: I am under the disadvantage of having had no practical experience of observations in the polar regions, but I can, nevertheless, realize the difficulties under which the observations are made. Perhaps it does not do to be too critical of the results which may be obtained from them. It would

be very desirable, no doubt, to have the original observations and to investigate them. I dare say the difficulties of fitting things in would rather surprise some of us. One knows quite well that it is not easy, even under most favourable conditions, to get three bearings to cut into a point when taken from three astronomical observation spots. I have never yet been able to do it satisfactorily, and that it must be still more difficult up in the Arctic regions I can fully realise. I think the lecturer referred to the necessity of taking observations on both faces of the theodolite. With a theodolite of ordinary pattern it is perhaps putting rather a heavy and unnecessary burden on the observer. His principal source of error lies, of course, in his level and collimation. These he can determine by separate methods, with less chance of disturbing the instrument. Frequently in our hydrographical work we do not observe on both faces, and I do not see, if it is good enough for hydrographical work, why it should not be good enough for polar work, provided the proper precautions are taken. I think there is an exaggerated idea of the accuracy of the observations that can be made in these regions. As regards the sextant *versus* the theodolite, under ordinary circumstances I am a strong upholder of the sextant, but in polar regions I think there can be no doubt about it that, considering the difficulty of observing with an artificial horizon at low altitudes, the theodolite must be preferable, and apparently that coincides with the experience of other officers. As regards the chronometers, the more recent chronometers of the Admiralty are keyless with quick train, so that they are very much better than the old pattern beating 5 to 2 seconds, which I think were supplied to the '75 polar expedition, and possibly to the *Discovery* expedition. Our recent pocket chronometers, if treated properly, are just as good as a box chronometer; they keep excellent time, and, by being fitted with quick train, beating 9 to 2 seconds, they stand very much rougher treatment without altering their rates. There is one other remark as regards the method which the lecturer proposes. It seems to me to depend upon the assumption that circles of equal altitude cut circles of declination at right angles. Now, in the figure which appears in the paper, when you are at the pole, of course your circle of declination is a meridian, but that is not so if you are not at the pole, and therefore it seems to me that this method can only be true absolutely when at the pole. I see the lecturer proposes using it within five degrees of the pole, but it would have an error, it seems to me, varying with the latitude and the hour-angle of the heavenly body. I may be wrong, and I should like to know if that has been considered by the lecturer?

Mr. HINKS: I think that there can be no doubt that the circle of equal altitude approximates very nearly to a straight line.

Admiral FIELD: I am not referring to the fact that the circle of equal altitude approximates to a straight line, but whether it cuts the circle of declination at right angles. I cannot see that it does.

Mr. HINKS: It is not on your own meridian; it is the meridian on which the sun is.

Admiral FIELD: I may be wrong, but that is as it strikes me.

Colonel S. C. N. GRANT: I should like to speak on one small point, and that is to explain an incident I have come across practically, about observing face right and left with a theodolite. I was once working in Africa with some foreign officers, and I found we were always differing by a fixed quantity in the results of the observations. One night I said I would like to see how they observed, and I found that one of the officers observed his north star face right, and the south star face left; east star face right, and west star face left. That is an error which perhaps people who do not thoroughly understand the subject might get

into. Trying to get right, this officer went more wrong than if he had observed on one face only. Can any gentleman tell us at what temperature the spirit used on spirit-levels will freeze, and at what temperature watch-oil will freeze?

Captain Scott: Watch-oil will freeze directly it is out.

Mr. Reeves: The spirit with which spirit-levels are usually filled freezes at −200·2°.

Colonel Sir T. H. Holdich: Nearly everything I proposed to ask the lecturer has been anticipated, but there is just one point to remark as regards the theodolite. I have not had an opportunity of observing under such Arctic conditions as Captain Scott, but I have taken a great many observations with the temperature below zero and in pretty deep snow. I do not see why Arctic or Antarctic explorers should limit themselves to so small an instrument as the 3-inch theodolite, although I admit that the main point is the vertical circle. I have myself always used a 6-inch theodolite with both horizontal and vertical circles, and with this I could observe a latitude to one second of arc; and I found great value in the additional size of the instrument when I had to watch what the levels were doing. I did not find that if the stand was fitted with shoes it sank appreciably; but I did find it an absolute necessity to observe on both faces. No observation would have been accepted as valuable that was not taken on both faces, because the double observation not only eliminates the zero error, but also the level error, which is more important. I also wish to know, at what temperatures do levels cease to act? I imagine that there is a point of low temperature when you cannot trust your levels. Under any circumstances, I am in favour of an equipment of one 6-inch and one 3-inch theodolite.

Captain H. H. P. Deasy: I should like to ask Sir David Gill if he considers it would be possible to observe planets in the daytime, with a 3-inch theodolite?

Sir David Gill: You can easily get Venus; I question very much whether you would see the other planets so well, but Venus is of course always easy to see, if you know where to point at.

Mr. Bernacchi: I have had a little experience in the Antarctic with instruments, and do not agree with the lecturer that the conditions are so arduous. Most of these observations are taken in the middle of summer; in the winter of course the difficulties are greater. I think the thodolite is perhaps the best instrument for polar work, provided you have an expert observer thoroughly competent to make all the necessary adjustments. At the same time a great deal of good work can be done with an ordinary sextant if properly adjusted. The glass horizon is utterly useless in the polar regions. I have great belief in the mercurial horizon. The sextant is seldom used at temperatures below −40°, and if you have a mercury horizon and use it in a round dish say 6 inches in diameter, I think you could do very good work indeed. With regard to the refraction tables, we very seldom had to employ them at low temperatures: in the few cases, I simply had to take ordinary refraction tables, and subsequently work out the formula on my return home. The lecturer referred to the chronometers and the important data that might be derived from the *Discovery's* chronometers. I do not think you would get very much information from those chronometers, as they were kept in the ward-room of the ship, where the temperature was practically uniform; but I had one chronometer employed for pendulum observations on shore. I think you will find, in the results of our physical observations, some interesting information with regard to the behaviour of that chronometer at low temperatures.

Mr. Reeves: For years past it has fallen to my lot to investigate and compute observations taken by travellers in all parts of the world, including the polar regions, and I suppose I have thus naturally become a sort of repository of the experience

of travellers generally as regards these matters. It is for this reason that I venture to make a few remarks on the subject before us. In the first place, it seems to me that, whether we attempt to plot the results of observations by the adaptation of Sumner's method as shown by Mr. Hinks, or by any other such arrangement, or whether we follow the more exact method of computation, the final result must depend upon the altitude; therefore the method of obtaining the most accurate altitude in the exceptional conditions of high latitudes becomes a question of the greatest importance. Since an explorer in these regions must travel by daylight, star observations are practically out of the question, and he is restricted to the sun. First, as regards latitude, the observation for which is doubtless the most important of any on polar expeditions, instead of a single-meridian altitude, it would be better to take the altitude of the sun both at its upper and lower culmination. By this means refraction will be very nearly eliminated, or, at any rate, it will only be a differential quantity for the two altitudes, and as the difference between the altitudes can only be a few degrees near the pole, this method of observation should certainly give a more accurate result than an altitude measured only one side of the zenith. It would further tend to eliminate instrumental or personal constant errors in the measurement of the altitude. With reference to instruments, there can be no question that, provided a firm foundation can be obtained for the stand, a theodolite is preferable to the sextant; but when this instrument is used, the altitude should be measured on both faces instead of one face only, and the level-readings should also be noted, as if this is disregarded, considerable error may at times be introduced. For this purpose the level should be on the vernier arm, and not on the telescope. However, the value of face-left or face-right readings only depends upon whether the instrument is in proper adjustment. When this is the case, and the readings have been found beforehand to be the same on both faces, an altitude taken on one face only should give a satisfactory result. Of course, a theodolite cannot be used except on land or firm ice; on moving ice there is nothing to be done but take altitudes with a sextant, with the best available horizon, either artificial or natural. But the latter is never likely to be very satisfactory. The best form of artificial horizon is doubtless the mercurial, when it can be used; but as mercury freezes at $-40°$, this may frequently be out of the question, unless it is warmed by some means or other, as I have known to have been done on more than one occasion. The silvered plate-glass artificial horizon is never so satisfactory as the mercurial, specially at low altitudes, but has the advantage of being light and portable. The best form of plate-glass artificial horizon is one in which the glass is blackened throughout, for if it is silvered or blackened only on the back, there may be a double reflection, which considerably distorts the image of the sun. The plate-glass artificial horizon has necessarily to be levelled by a spirit-level, and this must be most accurately performed. The levels should not be attached to the artificial horizon, but separate, so that in the process of levelling their ends can be reversed. Owing to vibration due to traffic, it is impossible to use the mercurial artificial horizon in the Society's observatory, so I have had considerable experience with the plate-glass pattern, and find that with care, when the altitude is not too low—say, 30° or over—it is possible to obtain the latitude from the meridian altitude of the sun to a greater degree of accuracy than is generally supposed. However, altitudes such as 6° and 11°, of which we have heard lately as having been observed for obtaining latitude in the north polar regions, cannot possibly give reliable results. Several attempts have been made to combine some form of artificial horizon with the sextant instead of having separate instruments, and the most recent of this kind is a pendulum arrangement designed by myself, and noticed in the *Geographical Journal* for December, 1908. By reversing the

reflecting mirror errors are to a great extent eliminated, and I see no reason why this arrangement should not answer well on polar expeditions, specially as it is suitable for taking low altitudes. Reference has been made by Mr. Hinks to altitudes of the sun, taken during a recent Antarctic expedition, on one face of the theodolite only. As before stated, the value of such observations depends entirely upon whether the instrument was in adjustment, and in the case of the observations taken by the Shackleton expedition on the southern journey, I find, after careful inquiry, that every care was taken to see that the adjustments were perfect. The observations for latitude during this journey were made with a 3-inch transit theodolite, reading to single minutes, similar in pattern to that taken by Captain Scott on his expedition, and the readings were checked by several members of the party before being written down. I have seen the original notebook containing the record of the observations, and, after re-computing all the latitudes, it is satisfactory to find that in no case did the results of my computations differ from those made by Dr. Marshall and verified by the other officers of the expedition by more than 1′, although I used the best refraction tables and applied all possible corrections. In the case of the furthest south latitude obtained, 87′ 22″, the result of my computation agreed with that previously obtained within 10″ of arc. In order to test what could be really done with a small 3-inch theodolite, I recently took a single-meridian altitude of the sun for latitude with a similar instrument, on one face only, without paying particular attention to adjustments, and obtained a result within 3′ of the correct latitude of the R.G.S. observatory. Taking all thecircumstances into consideration, I feel sure that the observations for latitude observed on Shackleton's furthest south journey can be relied on to within about 2′, plus or minus, of the result given on his charts. I can only speak for the Southern journey map, but the mapping of the magnetic-pole expedition I have every reason to believe has been most carefully done by Mr. Douglas Mawson, who is, I understand, a trained Australian Government surveyor of considerable experience.

As regards Mr. Hinks's chart, it is of course, as he admits, only a modification of Sumner's lines. Very similar methods have been used for years past, but I consider the manner in which he has plotted the lines to be original and ingenious. With reference to what Mr. Hinks states about the difficulties of time and longitude observations in polar regions being artificial, although I fully understand what he means by this, I think it must be admitted that in another sense the difficulty is often very real indeed. His own charts depend for their plotting upon Greenwich Mean Time. It is almost impossible to carry chronometers showing Greenwich Mean Time with anything like accuracy over the rough sledge journeys of polar explorers. Chronometers are all well enough on board ship, but when it comes to overland journeys through rough country, it is practically impossible to carry time, whether you have box chronometers or half-chronometer watches, unless careful and constant observations are taken to rate them. In very high latitudes the altitude observations for time necessary to rate the chronometers must be extremely uncertain, so that it becomes practically impossible to rate chronometers by the ordinary method, and to attempt to do so by any other method is usually quite out of the question. In lat. 88° an error in altitude of 8′ of arc will make an error of about a quarter of an hour in the time with an hour-angle of about five hours. Apart from the question of longitude, this uncertainty in Greenwich Mean Time has a direct bearing on the latitude observations, since it affects the corrections for the declination of the sun, which of course is given in the Nautical Almanac for Greenwich time.

Dr. STRAHAN: I have seldom heard a more interesting discussion than we have

had on this paper. It only remains for me to ask Mr. Hinks to reply, at not too great length, to the large number of questions that have been raised.

Mr. Hinks, in the course of a reply on the whole discussion, said that the greater number of questions asked had been answered already for him far better than he could do himself. He was glad to recognize that the consensus of opinion was in favour of the theodolite as against the sextant, and that it was generally agreed that it was not unreasonable to insist upon observations being made on both faces, even if pressure of time demanded that the alternation should be only from day to day. The very interesting statement of Captain Scott increased his desire that the observations should be published in detail. Captain Scott had remarked that if you observe the lower as well as the upper culmination of the sun during the perpetual daylight, you nearly eliminate the refraction and get your latitude accurately. It is equally true that a discussion of these observations would throw much light upon the amount of the refraction.

Mr. Reeves had suggested, in opposition to his view, that the difficulties concerning time and longitude were by no means artificial, but very real indeed; and had argued that a graphical method depending upon knowledge of G.M.T. neglected the fact that G.M.T. is difficult to carry, and almost impossible to determine during the Arctic day. In reply to this the speaker desired to point out that the graphical method was in this respect on all fours with other methods; you must know your G.M.T. approximately or you are altogether lost, until you get to the actual pole. The disadvantage of the ordinary methods was that they exaggerated the uncertainties due to the vagueness of local time and longitude. The graphical method avoided any direct consideration of these necessarily vague quantities, and at the same time exhibited in the most plain manner the uncertainties which were due to the uncertainty of G.M.T.

Admiral A. A. Chase Parr, a member of the Nares Expedition, 1875–76, sends the following :—

"Perhaps some of the experience gained in working the transit and alt-azimuth instruments during the winter of 1875–76 at the winter quarters of H.M.S. *Alert* may have a bearing on this subject. Also remarks on the behaviour of the pocket-chronometers and sextant during the sledge journeys.

"Two of the principal difficulties in using the transit and alt-azimuth were—(*a*) The formation of rime on the glasses of the telescopes; and (*b*) the levels being rendered sluggish by the cold.

"With regard to (*a*) the difficulty occurred mostly in the winter, and was greater with the transit, which was in a house, than with the alt-azimuth, which was in a snow hut without a roof. On more than one occasion observing had to be given up on this account. The observation of an eclipse of the sun which was being made from the top of a hill near the ship was interfered with from this cause, the temperature at the time being −37° Fahr.

"As to (*b*), our levels were specially filled with the purest spirit and very small bubbles. This answered perfectly as far as the bubbles were concerned, for even in the coldest weather they were always a suitable size. Below −40° Fahr., however, the spirit became so sluggish that the readings were not reliable. Good observations were obtained with a temperature of −39° Fahr., and others are recorded at −43° Fahr., but there is some doubt as to the value of these.

"Before −70° Fahr. was reached the spirit was of such a consistency that it was necessary to alter the level considerably before the bubble would move at all. Also the liquid had turned a brownish colour, which may possibly have been due to some impurity.

"No difficulty need be anticipated from handling instruments in cold weather.

As has been seen, they are useless from other causes when the temperature falls below − 40° Fahr., and experience shows that, in calm weather, it is quite possible to work an alt-azimuth for over an hour at that temperature with bare hands, uncovered as well as covered parts of metal being manipulated. At lower temperatures mitts would be worn, which would be sufficient protection in themselves. It might perhaps be advisable to put leather on the eye-piece, but elsewhere it cannot be considered absolutely necessary.

"The only instruments we took with us sledging were a sextant and prismatic compass. The latter worked well, with a variation of about 102°, while as to the former we had no reason to complain. We had no experience of a theodolite when sledging, but neither theodolite nor sextant would be of much value at temperatures below −40° Fahr. However, in the Arctic there is not much chance of the thermometer falling so low when the sun is high enough for observation, though in the Antarctic it may be different.

"With regard to errors induced in instruments by extreme cold, there was some difficulty in adjusting our alt-azimuth, partly owing to the cold and partly owing to the fact that the case it was in had suffered somewhat on the passage out. The result for the determination of latitude by observation of thirteen stars passing south and a similar number passing north was a difference between the two of 8″·5, which was quite good enough for our purposes.

"It is true that all the pocket-chronometers carried by sledging officers of the *Alert* stopped at some time or other, mostly for a short interval, and then went on again. To give a definite example of how two of them behaved. We left the ship on April 3, when one chronometer had a rate of 4·65 seconds daily losing, the other 7·75 seconds gaining. Soon after leaving a temperature of − 42° Fahr. was experienced. On May 6 the difference between the longitudes obtained by two observers using the same sextant, but different chronometers, was 51 seconds; on May 11 one of the chronometers stopped for about ten minutes without any apparent cause, and then went on again. On the same day the difference in the longitudes obtained by the two observers using the chronometer which had not stopped was 6 seconds, the altitude of the sun being about 17° and the latitude 83° 19′ N.

"The deck-watch was used for all observations with the transit and alt-azimuth, and on those occasions was fully exposed to the cold for perhaps two hours or more without its being much affected.

"During the summer, provided it is not required to observe altitudes less than 15°, and provided the distance from the magnetic pole is sufficient to admit of the compass working satisfactorily, a theodolite does not seem to be necessary.

"As in all probability the accuracy of the longitudes ascertained when sledging would depend upon the accuracy with which the longitude of the winter quarters had been determined, a word with regard to that may not be out of place. Owing to the causes which have been mentioned, and others which have not, it was not easy for a single observer to obtain good results from moon culminations, the greatest difference amongst eleven accepted observations being 54 seconds. With occultations, however, none of these difficulties existed, the only thing necessary being a clear sky. One observation was made at a temperature of −71° Fahr., and another during a gale of wind through a small slit in the housing, both with good results. The greatest difference among six accepted results was 11 seconds."

THE FORESTS OF BRITISH EAST AFRICA.*

A FIRST attempt at a systematic survey of the forests of British East Africa, by Mr. D. E. Hutchins, forms the subject of a Government publication (Cd. 4728, October, 1909). It is to be hoped that this is only a first step towards following the admirable example of systematic stocktaking of the natural resources set by Germany in its East African colony.

Clearly British East Africa is climatically not a forest land. Most of its surface is covered by savannas and various kinds of loose thorny scrubs, which rise from the coast to an elevation of 5500 feet. Most of this scrub is, in its present state, of very little use, even for fuel, and it is advised to try and stock it with the Cutch tree (*Acacia catechu*) and the mesquite (*Prosopis juliflora*) from similar climates.

What forests there are are of local occurrence, and conditioned either by the water contents of the soil or by the altitude. Due to natural irrigation are the two marginal belts along the Juba and Tana rivers, from 1 to 5 miles in width, and extremely unhealthy. Although they are not worthless, it is advised that they be cleared for agricultural purposes. Equally due to soil conditions are the mangrove swamps. Back of the latter, the feeble but rather broken relief which extends along the sea determines the existence of a narrow and scattered coastal belt of loose forests of a truly equatorial character, though comparatively poor. These lack good timber, and possess but little value. Teak, mahogany, and various kinds of rubber plants might be introduced with profit, but difficulties of access stand in the way.

To encounter important timber tracts, it is necessary to ascend the escarpments of the highlands and reach 5500 feet (Nairobi). It seems possible that a considerable portion of these highlands were once wooded, or, in other words, that a portion of what is now park-like savanna or scrub-forest may have been forest at one time. At present the main timber areas are found round the Kenia, on the broken Aberdare range, east of the Great Rift, in the Mau, and round the Victoria Nyanza. These forests are all of the tropical highland type, *i.e.* evergreen, broad-leaved rain-forests of the temperate form. Yet they vary greatly alike in density and composition, owing to the differences in rainfall and altitude, the drier portions being more scattered and poor, the wetter parts being densest. Broadly speaking, they fall into a lower zone from 5300 to 7000 feet above sea-level, and an upper zone from 7000 to 9300 feet. The Mau and Victoria, as well as the lower portions of the Kenia and Aberdare, would belong to the former zone. The wettest parts often consist of stands of tall bamboos some 60 feet high. In the main, the timber forests, though extremely variable, appear to be characterized by a low stock of timber per acre—the timber lacking in straightness and regularity of growth—and by a high percentage of unsound trees. In some forests not 10 per cent. of the cedar are sound. The natural reproduction is not strong, and may even fail. Great care has therefore to be exercised in lumbering. The timber of the lower reaches is varied and rather poor, but improves both in quality and uniformity with increasing elevation. The upper zone contains the largest timber and exclusively the conifers. It is topped by a belt of bamboos in some parts, and by a fringe of giant heath leading to elevated pastures and shrubs.

The outstanding economic species are: two yellow-woods, or Podocarpus, one cedar, or Juniper, the Ibean camphor (*Ocotea usambarensis*), and two wild Olive trees. On the average the stand would correspond to that of a fifth-class Scotch Pine forest. The timber is of fair quality. These forests are reported to correspond

---

* 'Report on the Forests of British East Africa.' By D. E. Hutchins. London: Wyman & Sons. 1909. With Map and 25 Photographs.

exactly to those which are found at sea-level along the southern coast of South Africa in the Knysna district, or to those of Natal (3000 feet) and Transvaal (4000 to 6000 feet).

Evidently there is room for the introduction of many valuable species from other countries with a similar climate, and a large portion of the book is taken up by a discussion of the possible species to be tried. The author is well inspired when he puts the "tierra templada" of Southern Mexico and Central America foremost as areas to draw upon. On the other hand, the omission of the Amazonian slopes of the Andes and of the Parana basin, as well as of the north island of New Zealand, is rather remarkable. On the whole the lists proposed are very mixed and require careful attention.

The great question at the present time is evidently the fuel-supply for the Uganda railway out of the railway forest belt. This supply is estimated to be able to last only for seven or eight years more. A new policy is therefore imperative, and the author appropriately advocates the wholesale planting of eucalypts and black wattle.

In Mr. Hutchins' opinion, the future development of the colony is intimately connected with the preservation of the highland timber area, not only as a source of timber, but also, and more seriously, as a source of water-supply. Indeed, these forests are absolutely needed as water-conservers. Already the natives, Masai and Kikuyus, have made dangerous inroads on the forests, both by cultivation and grass fires. There are also a few important concessions in process of exploitation. In the animal world there is threatened the disappearance of the elephant, which Mr. Hutchins rightly deems a very serious disaster.

The all-important geographical *rôle* of these forests, the necessity of sparing, and eventually helping, their low reproductive power, and of stocking them with valuable timber, and of staying the disappearance of the elephants, go to make the handling of the British East African forests eminently a Government concern which calls for immediate attention. It should be borne in mind that the forest area is computed at only 1·55 per cent. of the total area of the colony. The most serious consideration should therefore be granted to the protective measures recommended in the blue-book, and to the timely warning given therein.

M. H.

THE ANNUAL MEETING OF THE GEOGRAPHICAL ASSOCIATION.

Address by the President, DOUGLAS W. FRESHFIELD.

The annual meeting of the Geographical Association was held on January 8 last in the London School of Economics. According to the Annual Report, 168 new members have been added to the roll during 1909, the total membership being now 884, including teachers in every grade, school inspectors, and others interested in Geographical Education, both at home and abroad. Various lectures, specially intended for the teachers, have been given during the year in connection with the Association. A series of lectures on Methods of Geographical Instruction, delivered by Mr. G. G. Chisholm, Prof. R. A. Gregory, or A. T. Simmons, Mr. T. Alford Smith and Dr. Herbertson have been published in one volume, obtainable from Messrs. G. Philip & Son, 32, Fleet Street, E.C. Price, to members, 1*s.*; to others, 1*s.* 3*d.* post free.

Mr. Douglas Freshfield, the President of the Association, delivered his Annual Address, of which the following is a summary.

He said that the foundation stone on which the position of the Association in reference to geographical education had been based was the recognition of their study by the two ancient universities of Oxford and Cambridge. In the Cambridge School of Geography there had in the last year been some change. The Geographical Reader had been, so to speak, cut into three sections and distributed between as many separate Schools. This might extend the influence of geography in academical studies. On the other hand, there was some danger that it might detract from its conception and treatment as an independent subject. At Oxford they had to record, not change, but steady progress. Dr. Herbertson continued to build on the foundations laid by Mr. Mackinder. He was now engaged in a very arduous and important task, the endeavour to raise the nucleus of a fund for the permanent endowment of the School and also for the provision, when possible, of a suitable building for it. There was a notable opportunity offered to any man of wealth interested in geography of associating his name with a building worthy of Oxford and of the importance of the study to citizens of the British Empire. In Canada or the United States such benefactors were frequently forthcoming, and he had some hope one might be found in this country.

Meantime £1000 had been promised in two donations of £500 towards the needs of the School, and he believed that Lord Curzon, the present Chancellor of the University, himself a distinguished geographer, might be disposed to allocate a substantial sum out of the fund now being raised for the general purposes of the University for the same object.

Taking a wider view of the position of geographical teaching throughout the country, they might congratulate themselves on a substantial advance. The Association was growing in numbers, in resources, and in activity. Many successful lectures had been given in London and under the auspices of local branches in the provinces. It was proposed to extend the lectures to towns where there were as yet no branches. At Oxford the students had had the advantage of field-lectures from Prof. Davis of Harvard, which had been much appreciated.

At Glasgow, Captain Lyons, F.R.S., had been appointed to a Lectureship in Geography. At Dublin he hoped there would soon be a professorship. At Cork and Belfast Professors of Geology and Geography had been appointed. It was a combination on which he always looked with some suspicion, particularly when geology came first. Geology was a most interesting and important science, but it was also, to use one of its own terms, a singularly "intrusive" subject. They did not want geography taught as a branch of geology and in geological terms. The language of the geologists was in many cases, at least to his taste, objectionable! At any rate, many of its terms were very doubtful English, and could not be understood without an intimate knowledge of the classics. Moreover, the theories of geologists were often hypotheses, which vary from decade to decade, as to the action of physical agents in the past, whereas geography, dealing in the main with things seen, bases its arguments on existing facts. The distinction is indicated in the very names of the two sciences. He did not intend, however, seriously to disparage geology. His remarks must be taken rather as a retort to the attitude sometimes assumed by its professors.

It had been suggested to him that there was room for the practical application of local geography in connection with the new Town Planning Act, and he was told that several of their branches were making an accurate study of the surroundings of their respective towns and neighbourhoods. He could not imagine any more practical effort. While, however, such practical applications were very interesting for grown-up people, they must not forget that they had to deal in the first place with the education of children.

It was sometimes alleged that the child's instruction should commence with the things round his home, and not attempt to deal too soon with things far off. He thought this view neglected to take into account the imagination of the child. Curiosity about strange and distant lands was a common feature of the childish mind, and the teacher's object should be to excite interest by all the means in his power. While encouraging accuracy of local observation in his pupils, and making them reason from the things about them, he must lead them on to a knowledge of the distant wonders of the world. They had great aids in this task in the excellent series of cheap photographic plates, "Geographical Pictures," brought out by Messrs. Black and by Messrs. Philip, in the slides procurable by members of the Association, and in such recent works as 'The World of To-day,' and others of the same nature, amongst which he might mention the *Geographical Journal*.

GEOGRAPHY AT OXFORD.

At the beginning of the present term Convocation unanimously passed a decree constituting Mr. Herbertson Professor of Geography as long as he holds the office of Reader in Geography. This form of recognition is necessary because there is at present no endowment for geography, and a permanent professorship cannot be founded until there is. The need for such an endowment is emphasized in the Report of the Committee of the School of Geography for 1909, which has just been issued. A fund has been opened, and Mr. Douglas W. Freshfield and Lord Brassey have each promised to subscribe £500 provided a reasonable sum can be obtained. It is also reported that £175 subscribed to the Chancellor's Oxford University Endowment Fund has been ear-marked for the School of Geography.

The Report points out the steady growth in the number of students giving most of their time to the study of geography. In the Michaelmas Term of 1909 there were 32 such students, 15 men and 17 women, taking the Diploma and Certificate Courses in view of the University or the Higher Civil Service Examinations: 20 to 30 students attend Lecture Courses only. In the present term of 1910 there are 73 students—46 men and 27 women. Of these one is carrying on research work, 19 (10 men and 9 women) are studying for the Diploma or the Higher Civil Service Examinations, and 17 (7 men and 10 women) are taking the Certificate Course—in all 37 (18 men and 19 women). The income from fees, excluding examination fees, has grown from less than £110 in 1905 to £360 in 1909. Expenses, however, have grown much more rapidly than fees.

Endowment of teaching is not the only need of the School. The increase in the numbers attending the School, the increase of staff, and the growth of the collections of books, maps, models, etc., involving the introduction of new cases, have made the present accommodation quite inadequate. Temporary rooms have been rented. This very unsatisfactory arrangement is in itself insufficient. The Professor has drawn up a memorandum on the accommodation required for the School, allowing for a reasonable growth; but to secure it a large sum would be required for buildings, in addition to the cost of a site. A Geographical Colonial Institute, such as the Professor proposes, would be a great addition to the teaching and research resources of the University. As a temporary solution it was suggested that if the whole of the Old Ashmolean Building could be handed over within the next year or two to the School of Geography, the University would be relieved of the capital charges of a new site and building for a number of years. The trustees of the Chancellor's Fund were approached, and they offered to grant £500 towards the furnishing of the Old Ashmolean Building in this case. Unfortunately the interests

of the New English Dictionary and of the Bodleian Library render it impossible to give the rest of this building to the School of Geography, and no other is available. The University is faced with the problem of raising the necessary funds for a large new building.

A statute passed during the year allows the Geography Diploma to be registered for two groups, and any of the Certificates for one group in the Final B.A. Pass Examination, with certain restrictions. This ought to be taken advantage of especially by undergraduates preparing for teaching or for colonial appointments. The secretary of the Appointments Committee constantly reports that men with a geographical training are wanted, and the Professor has to reply that all the students of the School have already received appointments.

Undergraduates taking the Diploma Course are advised to spread it over more than one year if possible. This, however, adds considerably to the work of the staff, and so does the addition of a number of graduates and undergraduates preparing for the higher Civil Service Examination, for whom it has been found necessary to plan a special course.

The committee hoped that Dr. C. R. Beazley, who has been appointed Professor of History in the University of Birmingham, would continue for another year to lecture in the History of Geography, but he has intimated that this is impossible. The committee have congratulated him on his appointment, and thanked him for the work he has done for the School since 1901.

Mr. G. G. Chisholm, M.A., D.SC., Lecturer in Geography in the University of Edinburgh, was appointed Examiner in place of Mr. H. Yule Oldham, M.A., Lecturer in Historical and Economic Geography in the University of Cambridge, whose term of office had expired.

In addition to the ordinary courses of lectures on different aspects of geography, systematic tutorial instruction is given to all diploma and certificate students, and there are practical classes, seminars, and frequent excursions. Last year the students who chose Surveying as a special subject spent five weeks in North Wales, carrying out a large-scale survey under the direction of Mr. MacKenzie.

During the past year the special lectures delivered in connection with the School of Geography have been of exceptional interest, and the committee have to thank the distinguished lecturers who so generously gave them. Three dealt with mountain regions. Mr. Douglas W. Freshfield lectured on the Passes of the Western Alps, and Dr. Sven Hedin on his recent Travels in Tibet, in the Hilary Term; and Dr. M. Aurel Stein on Geographical and Archæological Exploration in Central Asia and Western China, in connection with the Ashmolean Museum and the School of Geography, in the Easter Term. Two were on N. American problems: Mr. George Anson Aylesworth, a special lecturer of the Canadian Government, gave an account of the Climate and Resources of Canada, and Mr. F. B. Vrooman summarized the work done and proposed for the conservation of the national resources of the United States during President Roosevelt's administration. In the Michaelmas Term, Sir Ernest Shackleton addressed an audience of undergraduates and graduates, who filled the Sheldonian theatre, on his expedition towards the south pole; and Lord Brassey showed his interest in the School by giving an address on the British Markets in Tropical and Sub-Tropical Countries, which he prefaced with an appeal for the endowment of the School of Geography.

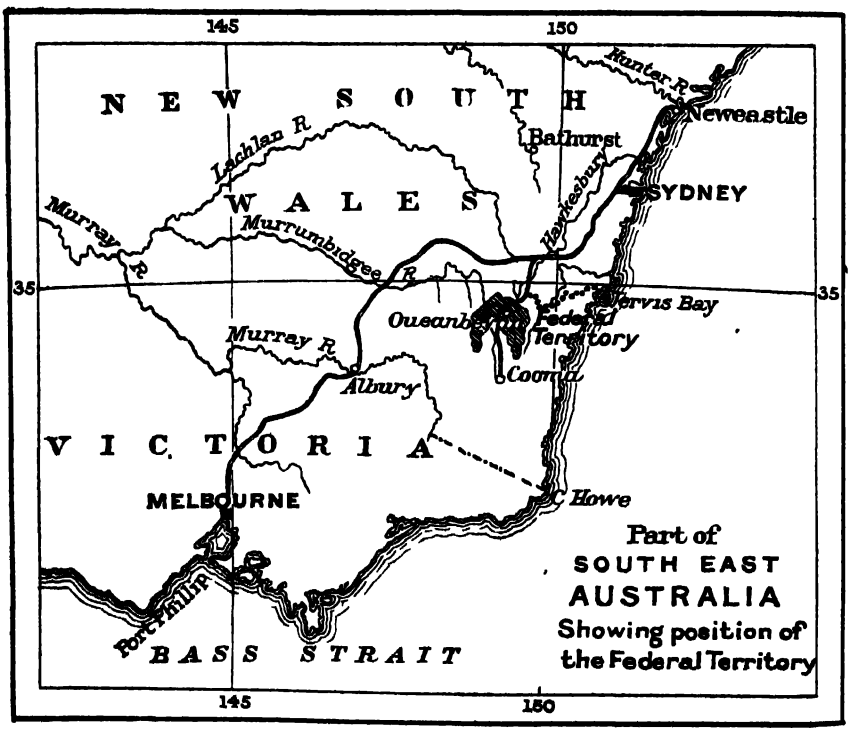
It has been decided to continue to ask, as part of the examination work in Regional Geography, for a geographical description of a district shown on any approved sheet of the 1-inch Ordnance map, based on personal observations in the district and accompanied by maps, sections, measurements, and statistical data. This has to be sent in at least a month before the written examination is held;

and so does not interfere with the final weeks of preparation for the rest of the examination. A number of these essays are of such quality that their authors have been asked to revise and extend them. It is hoped to publish a number of them in the course of the next year or two.

Over £1535 have now been spent on equipment, and many gifts have been received from our own and other governments as well as from private individuals. The school possesses 2809 books, atlases, and pamphlets, and 8852 maps. A bibliography of geography is being prepared, and about 14,000 cards are now ready. The collections of photographs and lantern-slides are very small, and contributions from Fellows of this Society would be welcomed.

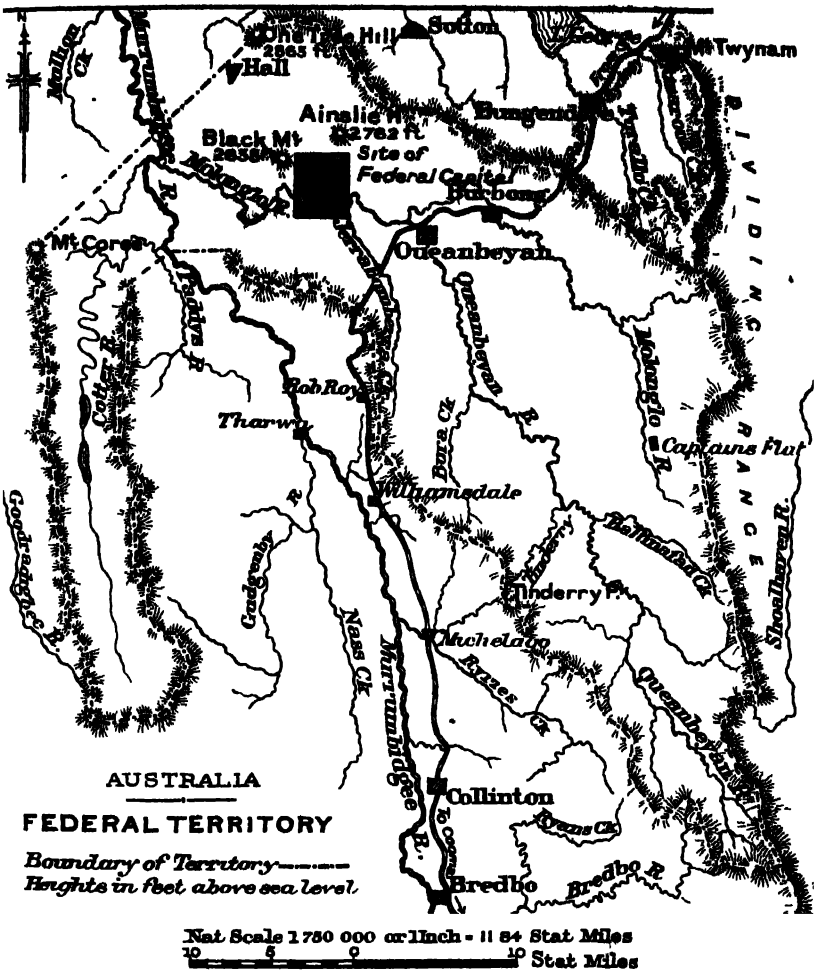
THE CAPITAL OF THE AUSTRALIAN COMMONWEALTH.

The accompanying sketch-maps, based on a series of maps and plans accompanying a report issued by authority of the Legislative Assembly of New South Wales,



show the position and general features of the site finally chosen for the Federal Capital of Australia, as well as the limits of the larger Federal territory acquired by the Commonwealth for the use of the capital. The question, which had been under discussion some years without making much progress towards settlement,

was narrowed down within comparatively small limits by the passing of the Seat of Government Act, 1908, which provided that the site of the capital should be in the Yass-Canberra district of New South Wales; that the territory to be acquired should contain not less than 900 square miles; and that it should have access to a suitable port on the sea. Early last year a Board was formed for the purpose of considering the claims of the several possible sites within the district in question,



having regard both to their scenic advantages and to the facilities they offered in the way of water-supply, drainage, etc. After full examination of the area by an expert surveyor, and repeated inspections by the members of the Board, a series of recommendations was drawn up in June, 1909, leading, before the end of the year, to the passing, both by the Legislative Assembly of New South Wales and by the Australian Parliament, of a Bill for the transfer of the territory. The site selected for the actual capital is at Canberra, on the Molonglo tributary of the Murrumbidgee, just below its junction with the Queanbeyan. In the choice



SITE OF FEDERAL CAPITAL

Area of City — · — · —

Contour lines with heights in feet above sea level - - 1850 -----

Proposed artificial lake to level of -------1825-------- *contour.*

Roads ═══

Limit of timber [illegible]

Natural Scale 1:50,000 or 1 inch = 789 Stat. Miles

0 ¼ ½ ¾ 1 Statute Miles

of the wider territory assigned for the use of the capital the principal consideration was water-supply, both for domestic purposes and also for the supply of power and for the creation of ornamental waters. This led to the inclusion of the whole catchment areas of the Cotter, Molonglo, and Queanbeyan rivers, somewhat exceeding 1000 square miles, as it was felt to be of the utmost importance that the whole area whence the supply might be obtained should be under Federal control. The present population within the territory is only about 4000. Of the rivers mentioned, the Cotter has the advantage of affording a supply of perennially clear and pure water, probably sufficient for domestic purposes, but for power it might be necessary to use the supply of the other two rivers. In order to regulate their flow and conserve a supply for ornamental purposes, the construction of weirs on their upper reaches is proposed. As a port for the capital, Jervis bay is considered to meet the requirements in a satisfactory manner, this most suitable area being situated at its southern extremity. A practicable route for a railway connecting it with the capital has been provisionally laid down.

REVIEWS.

EUROPE.

Iceland.

'Isafold, Reisebilder aus Island.' Von Ina von Grumbkow. Berlin: Dietrich Reimer (Ernst Vohsen). 1909. Pp. 292. *Price* 6m.

'Wüstenritte und Vulkanbesteigungen auf Island.' Von Carl Küchler, M.PHIL. Altenburg, S.-A.: Stephan Geibel Verlag. 1909. *Price* 6m.

These books are popular descriptions of travel in Iceland, and describe much the same part of the island, especially the northern region: Akureyri, the Myvatn, the Odáahraun, and neighbourhood. Herr Küchler, who is the author of several works on Iceland, its people and literature, here aims at giving a simple description of incidents of travel, the country, and life in Iceland as they appear to the ordinary traveller, omitting all scientific matter. Fräulein von Grumbkow penetrated more deeply into the interior, the object of her journey being to inquire into the fate of her *fiancé*, Walther von Knebel, who was lost in 1907 on a lake in the Askja-cauldron. When Thoroddsen visited the Askja in 1884 there was a small pool of hot water in the south-eastern corner of the cauldron, whereas in 1907 a large lake was found partly covered with a sheet of ice. The breadth of the cauldron, which lies in the Dyngufjöll, is about 5½ miles, and the lake, named the Knebel lake by Fräulein von Grumbkow, measures 2½ to 3 miles across. Close to its northern bank lies a crater sinking to a depth of 260 feet, from which a violent eruption took place in 1875. This was named after the young painter Max Rudloff who perished with Dr. von Knebel. Dr. Reck, who accompanied the authoress, descended by a rope to the edge of the boiling sulphurous water in the crater. Both books are profusely illustrated.

W. A. T.

'Guide to Avebury and Neighbourhood.' By R. Hippisley Cox. (London: Stanford. 1909. Pp. 68. *Maps.* 2s.) This is a useful brief guide to a prehistoric site which, if of less popular interest than Stonehenge owing to the less perfect condition of the remains, is of even deeper interest to antiquarians. The book is carefully mapped, and deals almost entirely with prehistoric remains; the references to places and buildings of historic interest in the Avebury district are somewhat exiguous.

'The Historic Thames.' By H. Belloc. (London: Dent. 1909. Pp. 204. 3s. 6d). This little book is by a master of a pleasant style, and presents the story of the Thames in a characteristically pleasant vein, without any effort towards originality. The volume is hardly so well produced as those of other similar series.

"Cambridge County Geographies." 'Cambridgeshire.' By T. M'K. and Mary C. Hughes. (Pp. xii., 271.) 'Cheshire.' By T. A. Coward. (Pp. x., 207.) (Cambridge: University Press. *Maps and Illustrations.* 1s. 6d. each.) The authors, editor, and publishers of this series continue a good work. These volumes bulk larger than earlier ones, and maintain their standard, that on Cambridgeshire being especially well done. Moreover, it possesses an index—an adjunct which has not been regarded as necessary in other volumes, and this is a move in the right direction.

'High Albania.' By M. Edith Durham. (London: Arnold. 1909. Pp. xii., 348. *Maps and Illustrations.* 14s.) From this authoress we anticipate, by experience, a volume full of entertainment and clever observation on any part of the Balkans which she may have visited. The present work is no disappointment, and renews our admiration at once for her writing and for her boldness as a traveller, for her wanderings in Albania were often over almost untrodden roads.

'A Military Consul in Turkey.' By Captain A. F. Townshend. (London: Seeley. 1910. Pp. 328. *Illustrations.* 16s.) The author is able to discourse both gravely about Turkish political and administrative problems and gaily about his own peculiar experiences. His official duties led him far afield, and his book would be well worth the attention of intending travellers to Asia Minor.

ASIA.

TIBET.

'Trans-Himalaya: Discoveries and Adventures in Tibet.' By Sven Hedin. In two volumes. London: Macmillan & Co., Ltd. 1909. 30s. *net.*

There is no necessity for a long or detailed examination of this book from a geographical point of view, because it is the popular edition, and will hereafter be followed by one on a still larger scale with scientific results and finished maps. Moreover, in this *Journal* of April, 1909, Hedin's paper on his journeys is published, as are the discussions and his reply which followed. It is therefore now considered less as a contribution to the science of geography than as a narrative of the author's travels and trials. These were unquestionably many and great, some natural, others provided by men, but were overcome by a perseverance, resource, and courage which command our admiration.

Dr. Hedin left Stockholm in October, 1905, and travelled by Constantinople to Seistan, on the East of Persia; thence to Nushki and Quetta, eventually arriving at Simla in May, 1906. Here he found that he was prohibited from entering Tibet from British India, but was made a guest by Lord Minto, the Viceroy, and during his stay at the Viceregal Lodge shared in various festivities which are well and amusingly described. Here, too, he hatched plots whereby he might effect his purpose, and in furtherance of them he set forth to Srinagar, where he stayed with Sir Francis Younghusband. Soon he went on to Leh, where his camp was finally arranged, and departing thence, ostensibly for Khotan and Turkistan, he found himself ere long in Aksai Chin, in north-west Tibet or on its border. For, as he says, this is a country which belongs to no Power. Is it part of Kashmir, or Tibet, or China? There are neither boundaries nor boundary stones. "From here, therefore, I could move eastwards without acting in direct opposition to the wishes of the English Government, and the Chinese would certainly forgive me for not using their passport."

So he set off, and had a rough time on the way to Lake Lighten, on which he

and his canvas boat went through many graphically described perils, but escaped. Thence he passed Lake Markham and turned southwards across Chang-tang to the Ngangtse lake, on which he spent the last night of 1906. Then, after the usual delays and deliberations consequent on the Tibetan authorities desiring him to return the way he came, and his natural repugnance to that course, they suddenly came to the conclusion that the simplest way of getting rid of responsibility was to pass him on to the next province across the Brahmaputra. This suited the traveller's plans, and to that decision Sven Hedin and his readers owe some most interesting chapters about Shigatse, Tashi-Lunpo, the Tashi Lama, and the ways and customs of the lamas. He was present at the losar, or new year's festival, which lasts fifteen days, the greatest of the four annual ceremonies. It celebrates the victory of true religion over infidelity, and is held early in February. The country people flock there and all are admitted, no distinction being made between rich and poor. The descriptions of the ceremonies, illustrated as they are by some of Hedin's extremely clever sketches, are of great interest to many besides geographers. The Tashi Lama made a favourable impression on the author, and is greatly praised.

Leaving Shigatse, he marched up the Brahmaputra, and remarks on "the violent storms from noon onwards which blew in our faces;" that is, from the west. "We were pestered with sand, which grated under our teeth, irritated our backs, and made our eyes smart. Where the valley was contracted, the compressed wind blew with double strength, and the sand-clouds rolled in a greyish-yellow mass along the Brahmaputra valley." Farther on he describes the peculiar country he was passing through on the northern bank; lakes and swamps surrounded by sandhills 26 feet high, and responsible for a plague of gnats. Here floods wash away the driftsand and deposit it lower down, but as the river falls fresh sand accumulates and new dunes are made. The country reminded him of Lob in Chinese Turkistan and the struggle there between sand and water.

On this journey Hedin diverged southwards to investigate the headwaters of the Kubi-Tsangpo, which he states is the chief source of the Brahmaputra, and thence he proceeded to the famous lakes Mánasarowar and Rákas-tál, the former of which furnishes drink for the gods and is sacred to them, whilst the latter, judging from its name, is the lake of evil spirits. With Mánasarowar Hedin was enchanted, and he apostrophizes it thus: "Wonderful, attractive, enchanting lake! Theme of story and legend, playground of storms and changes of colour, apple of the eye of gods and men; goal of weary, yearning pilgrims, holiest of the holiest of all the lakes of the world, art thou, Tso-mavang, lake of all lakes. . . . That is Mánasarowar, the pearl of all the lakes of the world."

On Rákas-tál he was blown in a storm to an island, a single rock falling sheer into the water. It is a breeding-place for wild geese in spring, and even when he was there he found thousands of eggs in nests of stone and sand.

The celebrated mountain Kailás lies north of these lakes, and is a great place of pilgrimage for Hindus and Tibetans. Its peak bears a striking likeness to the dome of a Hindu temple, whence, some say, comes the veneration accorded; the Tibetans call it Kung-rinpoche, "The holy ice mountain," and find its shape similar to a chorten.

From this neighbourhood, say within a radius of a hundred miles from Kailás, four rivers rise: the Indus and Sutlej, eventually flowing westwards and south; the Brahmaputra flowing east and south; and the Mapcha-kamba, or Karnali, which falls into the Ganges. These rivers are known as the lion, the elephant, the horse, and the peacock.

Hedin was sent back towards Leh, but before arrival he turned north and again found his way east to make another crossing of the unknown land; he finally returned to Simla by the Sutlej route.

Though discovery in its full sense is scarcely the word to be used in connection with his travels, Hedin has undoubtedly made great additions to our knowledge of these parts. By traversing in several directions the corrugated mass of hills which lie within the blank portion of the Society's map of Tibet (1906), south of the routes of Nain Singh, Bower, Littledale, and others, and north of the Tsangpo or Brahmaputra, he has unquestionably reduced the space which bears the word "UNEXPLORED." For this he is entitled to our warm congratulations and thanks, though, with Colonel Burrard, we realize that at present we have to be content with approximations to truth; in respect, however, to the discoveries of the chief sources of the Indus, Sutlej, and Brahmaputra, whilst fully recognizing the value of his work, we hold that claims to have found the true source of this river or that are of little value. The source or sources of every river are the areas of the catchment basin, the ultimate source being the rain or snowfall. One source or channel may carry more water one day, another more the next, and to dogmatize as to one stream rather than another being the true source of a river is unprofitable at any time, and probably incorrect till minute and accurate surveys have been made and discharges observed.

The author is anxious to have the range through which he has travelled called Trans-Himalaya, whilst others object to that designation. There is no doubt that name is open to objection for the sufficient reason that when placed north of it, it becomes Cis-Himalaya; yet many persons well qualified to form an opinion are content that it should be adopted. In this country the feeling seems to be that the name does not matter much, and therefore the traveller's wish may be respected; in India it is believed that the senior officers of the Survey Department dislike the name, preferring the old name, Kailás range. The dispute is one of those matters which, if left alone, will settle itself.

It may be noted that the author, whilst paying deserved tributes to the Survey officers and to the pundits who visited the country many years ago, has a somewhat unfortunate way of referring to the relative importance of his work and theirs. This is a pity; when the country is accurately surveyed—should that ever happen—his present sketch-maps will be found to require many corrections, yet that does not detract from their present value.

The volumes, which have been rapidly put together, would have gained by judicious compression; even as they are, the story is incomplete and a third volume is promised; but it is fair to add that they abound in interest and will appeal to a considerable and important section of the public. It is not quite clear whether Sir Sven Hedin—for he is now K.C.I.E.—is responsible for the English edition; an announcement was made in the *Athenæum* that "the rendering it embodies was made for Messrs. Macmillan & Co. by Mr. W. A. Taylor." This is not very clear, but, anyhow, there are few mistakes, and they are of little consequence. The illustrations are numerous and good, those from the author's pencil being conclusive as to his artistic skill. The publishers, too, are to be congratulated on the good type and general turn-out of the book.

W. BROADFOOT.

A JAPANESE PILGRIM IN TIBET.

'Three Years in Tibet.' By the Shramana Ekai Kawaguchi. London and Madras: Theosophical Publishing Co. 1909. *Map and Illustrations. Price* 16*s. net.*

This narrative, from the pen of a Japanese monk, deals with three years' exploration and residence in Tibet. Much of its peculiar interest arises from the fact that it presents us with a faithful picture of that strange country from an Asiatic and not from a European point of view, and thus reminds us strongly of Sarat Chandra Das's well-known journals. The similitude is not surprising

considering that the author spent most of the year 1898 in Darjeeling, and thus had the advantage of receiving both instruction and counsel from the redoubtable S.C.D., who appears to enjoy quite a dignified position there. Mr. Kawaguchi then passed on to Tsarang, in Nepal, where he stayed about fourteen months. All this time he was diligently studying Tibetan, so that when he finally set off for the forbidden land by a pass leading in the direction of Lake Manasarowar, he had quite mastered the Tibetan language. His route lay round the lake and Mount Kailas, and then eastward to Lhasa, along the northern side of the Sanpo by way of Tadum and Shigatze. In the course of this journey the author suffered extraordinary privations owing to inadequate equipment, as well as to the fact that for the first part of the route his only companions were two sheep, which carried his provisions and stores. On arrival at Lhasa, he applied for admission to the Sera monastery, and through his knowledge of the Buddhist scriptures and skill as a doctor he established a good reputation and became very popular. Eventually he was presented to the Dalai Lama, who received him very favourably. This was previous to the despatch of the Younghusband Expedition, and the prevalent feeling at that time was strongly anti-British. The daily life in Lhasa, the manners and customs of the Tibetans, their trade and industries, and the curious negotiations with Russia, culminating in the despatch of several camel-loads of firearms and ammunition,—all these topics are handled in most interesting fashion. Mr. Kawaguchi's book is put together with more literary skill than Sarat Chandra Das's older narratives, and its fuller and more recent information combine to make it probably the best and most up-to-date description of a country which is bound for some time to come to exercise a mysterious fascination over the Western reader.

AFRICA.

The Partition of Africa.

'The Map of Africa by Treaty.' By the late Sir E. Hertslet, K.C.B. Third edition, in three volumes, and a collection of maps. Revised and completed to the end of 1908 by R. W. Brant, Librarian and Keeper of the Papers, and H. L. Sherwood, of the Foreign Office. London: Printed for His Majesty's Stationery Office by Harrison & Sons, St. Martin's Lane. *Price* £3.

Sir Edward Hertslet's 'The Map of Africa by Treaty' was first published in 1895; a year later a revised edition appeared. Since 1896 changes of importance in the political colouring of the map have been made, such as the wresting of the Eastern Sudan from the Khalifa and the renunciation by Italy of her claim to a protectorate over Abyssinia. Minor changes, caused chiefly by the delimitation of boundaries, have been very numerous. Hence the appearance of a third edition of the book is very welcome. The work of revision has been ably accomplished by Messrs. Brant and Sherwood, who have included all treaties and agreements involving territorial changes in Africa concluded down to the end of 1908. The first volume is now devoted entirely to British colonies, protectorates, and other possessions. These have been grouped in three distinct divisions: (1) West Africa, (2) South and Central Africa, (3) East Africa. (The Anglo-Egyptian Sudan, which owns a double sovereignty, is given under Egypt.) In the second edition, British possessions had been given alphabetically, and were not placed in a separate volume. The new arrangement will be found convenient. In this first volume can be traced the successive steps by which the boundaries of British possessions have been fixed, references being given to the texts of the agreements between Great Britain and other Powers contained in volumes 2 and 3, where also will be found all treaties between states other than the United Kingdom. Colonel Close's valuable map

and table (revised to January, 1909), showing the progress made in the delimitation of British frontiers in Africa, has been reproduced from the Colonial (Survey Committee's) reports; this adds distinctly to the value of the work.

Another change of importance in the book is the addition of a separate case containing forty-five maps, of which one is a general map of Africa, and the others reproductions of maps attached to original documents. They date from 1895 to 1908, and the great majority illustrate agreements to which Great Britain was a party; a few, such as the map showing the French Congo and Cameroons frontier, are of foreign possessions on both sides. Where these large-scale maps are given diagram maps have been bound up with the text, and in all other cases the best available map will also be found bound with the text.

In revising the work the editors have taken the opportunity of inserting many documents omitted from the earlier editions. The present edition is therefore much more valuable than its predecessors. It does not contain every document relating to territorial changes (for instance, the agreement concluded in 1890 by which Lewanika acknowledged the supremacy of the British South Africa Company in Barotseland is not mentioned), but its omissions are of no great consequence. The editors seem to be in error in stating (p. 285) that Nyasaland territory was ever administered by the Chartered Company; the documents cited, pp. 278–280, do not bear that construction, and the fact is that it was part of Rhodesia which was for a time under the control of the commissioner of Nyasaland, not *vice versâ*. With regard to the transfer of the Independent State of the Congo to Belgium, no mention is made of the "Additional Act" (to the treaty of cession of November, 1907) of March 5, 1908, abolishing the *Domaine de la Couronne*. Possibly the annexes of the treaty of 1907 were remodelled so as to secure the object of the "Additional Act"; the point might be cleared up had a summary of those annexes been given. Criticism of this kind serves, however, but to show the general excellence of the work.

F. R. C.

South African History.

'South Africa from the Great Trek to the Union.' By Frank R. Cana, F.R.G.S. London Chapman & Hall. 1909. 10*s.* 6*d. net.*

As indicated by the title and clearly stated in the preface, this is mainly a politico-historical work, dealing with the period of South African history which runs from the Great Trek movement (1836) to the present Union (1909). On the strictly historical section, which occupies the bulk of the volume, we need not dwell, beyond remarking that the claim to have treated without bias the stirring events here recorded is fully justified, due consideration being paid to the rivalries and aspirations of the two paramount British and Dutch races.

We turn, therefore to the concluding chapter, in which a summary, but on the whole very accurate, survey is given of the broad features of the region between the Cape and the Zambezi, its geographical outlines, climate, topography, inhabitants, products, and economic condition. Here the outstanding impressions made on the traveller moving northwards are vividly depicted, and we read how the successive ranges rise abruptly from the coastlands to the vast inland plateau; how isolated hills, some flat-topped, some pointed, are passed; and how all the features of the ascending karoos are repeated on an enlarged scale on the veld, the inner and limitless plain which stretches away from the last inner range to the Zambezi. The air is clear and exhilarating, the rolling grass-covered downs give the impression of the sea, from which tafelberg, kopje, and rand rise like islands. But the English visitor feels a great sense of loss—there are no trees, nor is there any running water, even the Orange and the Vaal and all the other streams being empty

before the rains. "The reflective stranger who has seen these waters allowed to empty into the ocean and leave the land on either side still an arid wilderness cannot but regret that South Africa has not an irrigation system like that of Egypt or India."

Some attention is paid to the Kafir and coloured problems, and reference is made to Mr. F. W. Bell's valuable paper on "The Native as a Political Factor" (1908). But the Bechuanas are wrongly stated to be the first Bantu arrivals from the north some time before the sixteenth century. They were most probably preceded by the Zulu-Xosas, if not by the Ova-Herero, some thousand years ago. Nor do these Herero speak a Hottentot language, but a very pure and typical Bantu tongue. It is their cousins, the Hill Damaras, that have become Hottentots in speech.

There is a not too full index, besides two serviceable maps, one showing the growth of British South Africa, the other the same region under the Union Act of 1909.

A. H. K.

'Loi sur le Gouvernement du Congo Belge.' (Luzac & Co., Great Russell Street, W.C. 1909.) This is a valuable compilation giving in parallel columns the text of the various proposals considered by the Belgian chamber for the government of the Congo, including the law as finally voted in 1908. Thus can be traced the numerous modifications in the direction of parliamentary control which were made by the legislature, before it consented to the transfer of the Congo to Belgium. The discussions in the famous Commission of XVII. and in the legislature on the proposals of 1907 and 1908 are also summarized, and an analysis is given of the abortive *projet de loi* of 1901. This laborious task has been accomplished by Mr. J. Tourney-Detillieux, an ex-senator and deputy and member of the colonial council. The arguments put forward on all sides appear to be impartially stated. Had the text of the treaty of annexation been given, the usefulness of the volume would have been increased.

AMERICA.

Panama and Ecuador.

Dr. E. Festa, 'Nel Darien e nell' Ecuador. Diario di Viaggio di un Naturalista.' 1909. Unione Tip.-Editrice Torinese, Torino. Pp. 397. *Price* 10 *lire*.

The author, who had previously journeyed in Tunis, Lower Egypt, and Syria, set out in 1905 to the Panama peninsula, where he made excursions to the Rios Tuyra, Sabana, and other streams flowing into the Golfo de San Miguel, and then sailed southwards to Ecuador. Here he spent several months in the east of the province of Azuay, among the headwaters of the Rio Santiago, which he wished to descend to the Pongo de Manseriche, but was prevented by the difficulty of procuring porters. He then travelled northwards through Riobamba, Quito, and Ibarra to Tulcan, and would have proceeded to the source region of the Rio Aguarico if the Columbian Government would have allowed him. He also visited the forests of the Rio Daule. Dr. Festa made a rough traverse of the country about the source streams of the Rio Santiago, and his observations and those of Señor Giacinto Pancheri are utilized in a map based on those of older cartographers. On the whole, however, his work is of interest to the zoologist rather than to the geographer. He made large collections of specimens from all sections of the animal kingdom, and discovered many species new to science. A list is given at the end of the volume, but much of the material has yet to be worked up, and therefore the value of the collections cannot at present be fully appreciated. Notices of the distribution of the fauna are numerous throughout the work. Dr. Festa also collected some

ethnological objects, and describes the habits and customs of the Jivaros and other tribes with which he came in contact during the two years and a half he spent in the country. The work is illustrated by seventy-two photographs and two maps.

W. A. T.

Explorations in Southern Brazil.

'Commissão Geographica e Geologica do Estado de S. Paulo.' Exploração do Rio Tieté 1906 (1907); Exploração dos Rios Feio e Aguapehy, 1905 (1906); Exploração do Rio Peixe, 1907 (1907). Folio.

The Geographical and Geological Commission of the State of S. Paulo has recently been carrying out a survey of the Paraná and its more important tributaries in the State with a view to the development of the country, which has hitherto been seriously retarded by the hostility of the Corôados, a tribe of Indians who receive their name from the crown of feathers that forms their headgear.

There are five important streams that flow north-westward through the state and empty themselves into the Paraná. These are, commencing from the north-east, the Rio S. José dos Dourados, the Rio Tieté, the Rio Aguapehy, the Rio do Peixe, and the Rio Santa Anastacio. Of them the Tieté is the most important. It rises in the Serra do Mar close to the Atlantic, and flows across nearly the whole breadth of the state. The upper portion being already well known, the recent expedition under the leadership of Senhor George Black Scorrar only explored the portion between Laranja Azeda at the mouth of the Jacaré Guassú (or Jacaré Grande), and the Paraná.

Senhor Guilherme Florence furnishes us, however, with an interesting account of the geology of the whole stream. It flows through granite and crystalline schists, except where it traverses the small Tertiary basin on which the capital of the state is built. At the Salto de Ytu it passes into sandstone and shales, which are probably of Upper Carboniferous age. Here it is interrupted by a number of rapids, which, above Porto Feliz are usually formed of sandstone, and below, of a rock described as a "diabase porphyrite." About 15 miles above the mouth of the Sorocaba the river enters a region in which sandstone and shales are interstratified with fossiliferous limestone and chert of Permian age. The massive red Botucatú sandstone, which is believed to be of Triassic age, is next encountered. It first comes in below the point where the river Piracicaba enters the main stream, and extends into the tract examined by the expedition. Interstratified with it are flows of "diabase," the outcrops of which, often repeated by faulting, give rise to numerous rapids and cataracts. On the banks the diabase weathers to a red fertile soil known as *terra rôxa*. At the port of Cordeiro a still younger formation, the Baurú sandstone, is met with. It is a pale, whitish calcareous sandstone without lava-flows, and for the 43 miles over which it extends the river is deep and with almost imperceptible current, so that it is known as the Rio Morto, or Mansa da Viuva. At the mouth of the Fartura stream the Botucatú sandstone reappears with its lava-flows and its cataracts, of which the most important is the Salto de Avanhandava. Below the Escaramuça rapid the Baurú sandstone appears for the second time, and gives rise to another stretch of quiet water till, at the Salto de Macuco the Botucatú comes in for the third time with the same features as before. It affords, however, one tract of smooth water—the Manso de Lambary—extending over 12 miles from the Corredeira (rapid) de Araçanguá to the Corredeira das Cruzes, and due to the absence of lava-flows. The lavas and cataracts then recommence, and continue at intervals through the remainder of the course of the river, concluding with the magnificent Salto de

Itapura near the confluence with the Paraná, which has itself just passed the Salto de Urubupungá.

The latitude of the more important points were determined by meridian altitudes, but there do not appear to have been any really satisfactory observations for longitude. The altitudes above sea-level were obtained by barometric readings compared with those at the meteorological station at Mattão. These gave a height of 1289 feet for Laranja Azeda, and 889 feet for the mouth, a descent of 400 feet in 230 miles. A calculation based on the levelling of the rapids and falls, and an estimated average slope of the quieter portions of the river of 13 in 100,000 gave practically the same result.

The exploration of the river Aguapehy, known in the upper portion of its course as the Feio, was undertaken by Engineer Olaf Hummel, but on his being wounded by the Indians, Senhor Gentil Moura took over the charge of the expedition. The Feio rises in the Serra de Agudos, apparently at a height of about 2300 feet, and on emerging from a deep and narrow valley unites with the Rio Presidente Tibiriçá of nearly equal size to form the Aguapehy, which is navigable with canoes, though occasionally interrupted by rapids. It finally enters the Paraná at a height of 853 feet after a course of about 476 miles measured from the source of the Feio.

A road was cut through the forest from near the source to the junction of the two streams that constitute the Aguapehy, which was descended to its mouth by a party under second Adjutant Bierrenbach. The land portion of the route was surveyed by tacheometer, the river only by watch and compass. Interesting details are given of the Guarany Indians, and the huts and implements of the Corôados. The flora is described in detail by Senhor Gustavo Edwall. The rocks are mainly sandstone, but diabase outcrops give rise to the cataracts.

The next tributary of the Paraná is known at its source as the Rio do Peixe, and at its mouth as the Rio do Tigre. It was explored under the direction of Senhor João P. Cardoso. It rises at a height of about 2000 feet, and for 100 miles flows with a somewhat rapid current, but is uninterrupted by falls, except one less than 2 feet in height. A tract about 12 miles in length follows with numerous rapids and three cataracts, the greatest of which is more than 25 feet in altitude. The river then flows slowly on for 118 miles in a series of meanders to its junction with the Paraná at a height of 837 feet above sea-level. Detailed information is afforded with regard to the Corôados and other tribes.

These publications are furnished with charts on the scale of 1 : 50,000 (1¼ inch = 1 mile) and a large map on a scale of 1 : 500,000 (1 inch = 7·9 miles), as well as with other maps and profiles and numerous reproductions of photographs.

J. W. E.

'Guide-book to the Lake Louise Region.' By W. D. Wilcox. (Washington, D. C.: Judd & Detweiler. 1909. Pp. 54. *Map and Illustrations.*) This may be recommended as an excellent guide to this most beautiful region of the Canadian Rockies. The photographs do justice to the scenery, the large map shows routes and elevations clearly, and the text carefully appraises the various view-points and the ease or difficulty of the routes. There are some valuable climatological notes from the author's own observations, and numerous hints as to camping and equipment.

'The New North.' By Agnes Deans Cameron. (New York: Appleton. 1910. Pp. xx., 398. *Map and Illustrations.*) The authoress of this volume travelled from Chicago by way of Winnipeg, Edmonton, and the Athabasca to the mouth of the Mackenzie, a sufficiently venturesome journey. She paints her experiences in

glowing colours, and gives a clear picture of the present state of the outposts of civilization and the economic possibilities in the far North-West. She also provides tables of travel rates, times, and distances, where transport is more or less organized beyond the limits of the railway, and pending further developments these may be found useful.

'Camps and Cruises of an Ornithologist.' By F. M. Chapman. (London: Hodder & Stoughton. 1908. Pp. xvi., 432. *Illustrations.* 12s.) There is a peculiar fascination about the narrative of the daily life of birds as observed at close quarters in many lands. This book is enhanced in interest by some very fine photographic studies of birds.

'The Picturesque Hudson.' By Clifton Johnson. (New York: Macmillan. 1909. Pp. xiii., 227. *Illustrations.* $1.25.) Messrs. Macmillan no doubt find in America a demand for such picturesque topographical books as their London house produces in the "Highways and Byways" series and others. This volume belongs to the "Picturesque Rivers" series, and is well written and illustrated with photographs.

'In an Unknown Land.' By Edward Robinson. (London: Elliot Stock. 1909. Pp. xi., 155. *Illustrations.* 3s.) In this unpretentious volume the author gives good reason for his belief in the commercial future of Labrador as a mining or lumbering region, if its physiographical difficulties can be overcome. He describes the country and his experiences in a simple and easy style, and shows himself to be possessed of the power of scientific observation.

EXPEDITION OF H.R.H. THE DUKE OF THE ABRUZZI TO THE KARAKORAM.

On February 16, H.R.H. the Duke of the Abruzzi delivered a lecture before the Italian Alpine Club on his recent expedition. It is, of course, impossible to deal with the scientific results which he has gathered until the maps and other records are published *in extenso*. But treated merely as a mountaineering exploit, there are very sufficient grounds for congratulation, and the high level of the duke's long record of successes is more than maintained by his latest effort.

Leaving Srinagar on April 23, the Zoji La was crossed to the Indus valley, in spite of wintry conditions on the pass, which was not officially open until the middle of May. Travelling with remarkable rapidity, the expedition arrived on the upper Baltoro glacier within a month from the start. The goal of the expedition lay among the great circle of peaks surrounding the head of the Baltoro glacier; and if K_2 was the first objective, it was always contemplated that one of the other giant peaks in its neighbourhood might afford a better chance of success. This, indeed, turned out eventually to be the case. From a base camp halfway up the Baltoro glacier, a light camp was pushed up to the foot of the southern wall of K_2, and from here the mountain was thoroughly explored in various directions. But no route promising any reasonable hope of success could be detected even by the trained eye of experienced mountaineers. The whole mountain on this side proved to be very

steep and only too well protected by hanging glaciers. The only safe routes lay up arêtes so steep and difficult that it was impossible to carry up even the lightest equipment, and though a fair altitude was reached on one of these ridges, the attempt had to be abandoned.

The west side of K_2 proved only slightly less uncompromising, and with great difficulty the Duke reached a high col on the waterparting overlooking the upper Oprang valley—a region which has been traversed only by Younghusband. All hope of ascending K_2 being now abandoned, the expedition proceeded with the survey of the upper basin of the Austen-Godwin glacier. From a ridge south-east of Staircase peak the Duke obtained a view of the northern precipices of K_2, and got a most important sight of the unknown country to the east, which lies beyond the Oprang glaciers explored by Younghusband in 1888, and to the north of the main Karakoram waterparting.

The only very high mountain in the neighbourhood the conquest of which seemed at all practicable was Bride peak (25,110 feet). Though the best of the season (June) for high ascents was now over, it was decided to attempt this peak. After returning to the main base camp a secondary base was established, apparently in the neighbourhood of Conway's "Footstool camp," north of Bride peak and west of Golden Throne. With considerable difficulty, owing to the broken and crevassed nature of the glacier, a temporary camp was established at a height of 21,000 feet on the Chogolisa saddle. In this terribly exposed situation, and with only the bare necessities of life, the Duke remained for three weeks. Such a feat is quite unprecedented in the annals of mountaineering. The degree of courage and endurance necessary to withstand the physical and mental strain of so prolonged a sojourn at such an altitude can only be realized by those who have actually experienced the dispiriting and debilitating effects of very low atmospheric pressures. That the strain was borne for so long a time must give encouragement to those who have maintained that the highest peaks on the globe are not beyond the powers of exceptional individuals, provided that the other conditions are also favourable.

In the present instance frequent fogs and snowstorms greatly hindered the party, and enormously increased both their difficulties and the risks they ran. Their highest camp works out at about 22,400 feet, the greatest altitude by several hundred feet at which human beings have passed a night. Two definite attempts were made to climb the peak by its eastern arête. On the first, a height of 24,000 feet was reached. This in itself would have constituted a record, for no one else has ever claimed to have actually reached this height on any mountain. But this was surpassed on July 18, when the Duke and two guides reached a height of 24,583 feet. Here, within 500 feet of the summit, a dense fog with wind and snow stopped the party. The ridge was badly corniced, and it was impossible to advance in such weather

without running a risk such as no experienced mountaineer would consider justifiable. The party remained three hours at this spot in the hope of the weather clearing, and had it done so it is certain that the summit would have been gained and the level of 25,000 feet above the sea successfully passed. Every English climber will regret that so gallant an attempt was not crowned with complete success. But as it stands, these two climbs on Bride peak and the three weeks' bivouac on Chogolisa saddle surpass all previous achievements in the annals of high mountaineering. T. G. L.

THE MONTHLY RECORD.

EUROPE.

The Fichtelgebirge in Literature.—A Leipzig dissertation by G. Schultze deals comprehensively with the Fichtelgebirge as a geographical unit. The author treats successively of the development of knowledge of the range, its limits at various epochs, its structure and drainage, communications, mineral resources, settlement, nomenclature, etc., each aspect being appreciated in its causal relations with every other. No general summary of its contents is here possible, but a few notes may be given on the Fichtelgebirge as known to successive ages. The "Hercynian forest" of Aristotle becomes in Strabo the *Gabreta Silva*, and in Ptolemy the Asciburgian and Sudetian mountains. Of the Bohemian rivers, ancient geography knew only the lower courses of the Main, Saale, and Naab. The discrimination of the Fichtelgebirge from the Bohemian *massif* was effected through the intercourse, dating from before the time of Charlemagne, across the passes severing it from the neighbouring mountains. The Ebstorf map (thirteenth century) shows the neighbouring headstreams of the Danube, Rhine, Main, Saale, and Naab. Matthias of Kemnath, who died in 1478, lingers in his *Chronicle* with exceptional detail on the mountains of his childhood: "a mountain high and broad, belonging half to the Palatinate and half to the Margravate of Brandenburg." The Fichtelgebirge, according to this author, has a circumference of 6 miles, "good measure," and, as centre of a great river-system, the double Fichtelgebirge is the most important mountain in Germany, visited by pewterers and shingle-makers, but otherwise only by murderers and robbers. He describes its lake, not frozen in winter nor frequented by bird or fish; its abundance of trees; its gems and minerals; the pedlars who carry away its schorl, selling it at Venice at five florins the bagful; the snows which sometimes bury its villages. A visit to the mountain in 1502 called forth from the poet-laureate Celtes a series of poems, celebrating the four rivers all issuing from the lake at the summit. Specimens of the laureate's and of Michael Barth's later description (1556), reproduced in German hexameters by Prof. Partsch, are included in the monograph. Starting at the sources of the Danube and Neckar, the Hercynian forest of Celtes embraces Eichstädt, Nuremberg, Sandland, and the Noric region, throwing off from the Fichtelgebirge four "giant horns" to the four quarters of heaven, and walling in Bohemia on every side. A map on his title-page shows the four rivers issuing from one lake. A more exact topography is to be found in Bruschius (1542), Willen (1692), Pertsch (1677), and in later writers. On the evidence of his own eyesight, Bruschius locates the source of the Eger on the mountain named "Heid." The altitude of the range as now known is a huge come-down from the 42,000 feet once assigned it.

ASIA.

An Expedition to North-West Mongolia.—An expedition organized by Mr. Douglas Carruthers, in conjunction with Mr. J. H. Miller and Mr. M. P. Price, who are financing it, will leave England at the end of March for North-Western Mongolia. The chief object of the expedition is to explore zoologically, botanically, and, as far as possible, geographically, the basin of the upper Yenesei river. The journey out will be made through Russia and Siberia to Krasnoyarsk, and thence up the Yenesei to Minusinsk. Here the expedition will fit out, and, leaving Russian territory, pass over into Chinese Mongolia. The upper Yenesei and its tributaries are almost completely surrounded by high mountain ranges, which form a secluded basin. In this basin dwells a curious tribe, the Sayotes, who appear to be confined to this restricted area. On the completion of the work in the actual basin of the upper Yenesei, the expedition will pass through Dzungaria to Kulja, which will be reached some time in November. After this Mr. Carruthers and Mr. Miller hope to winter in the Tarim basin, and then to continue their explorations in the spring in the Chinese provinces of Kansu and Alashan. That there is much of interest to record about the tribes of this region is shown by the fact that it includes the original homes of the Turkish and Finnish races. Zoologically, the Yenesei is important as being the line of demarcation between the faunas of eastern and western Siberia. And if the expedition is able to reach Alashan and neighbouring regions, there will be valuable geographical work to be done and problems regarding the desiccation of Central Asia to be solved.

AFRICA.

The Railway System of the Anglo-Egyptian Sudan.—The following information as to the Sudan railways has been communicated from an official source. In January, 1910, the following lines were open to traffic: (*a*) the line from Wadi Halfa to Khartum *viâ* Abu Hamed and Atbara junction; (*b*) the line from Atbara junction to the Red sea; (*c*) the branch line from Abu Hamed to Kareima in the Province of Dongola; (*d*) the extension southwards from Khartum to Wad Medani on the Blue Nile. The railway line from Wadi Halfa *viâ* Kosha to Kerma, which was completed in 1897, was dismantled and pulled up in 1905; the Dongola province being now reached by the Abu Hamed-Kareima line, (*c*) above, which, like the Nile Red Sea railway, was opened in 1906. The terminus of the Halfa-Khartum line is on the right bank of the Blue Nile opposite the city of Khartum, and the first step necessary towards its further extension was the construction of a railway bridge over the Blue Nile. This is to be completed and opened for traffic in the spring of 1910. Work on it was, however, in a sufficiently advanced stage in April, 1909, to admit of construction-trains being passed over carrying material for the extension southwards, and this reached Wad Medani (110 miles from Khartum) in December, 1909. During 1910 the line will be further extended to Sennar, and then westwards to Rabak on the White Nile, in N. lat. 13° 8′. The bridge to carry the railway across the White Nile at this point is now in course of construction, and will, it is hoped, be completed by the end of 1910. The route from the White Nile to El Obeid has not definitely been decided in all its details, but it will probably make a slight *détour* to the northwards as far as Kosti, and then turn westward to El Obeid *viâ* El Rehad. The construction of a branch line from Sennar to Singa is under consideration, but it seems probable that the El Obeid extension will have preference.

French Equatorial Africa.—The definite incorporation of Wadai within the territory administered by France, by the occupation of its capital Abesher in June, 1909, has been followed by some change in the organization of the whole territory

formerly known as French Congo, coupled with a change in its official designation. The old name has long been felt to be unsuitable, as the territory so designated stretched far outside the limits of the Congo basin, both on the coast and in the far north, and that of French Equatorial Africa has now been substituted. At the same time, by an order published in the *Journal Officiel* of January 16, the government of the territory will be brought into line with those of West Africa, Madagascar, etc., a distinction being made in matters of finance between the colony as a whole and its subordinate parts. A concise narrative of the events leading up to the occupation of Abesher by Lieut. Bourreau (under the orders of Captain Fiegenschuh) will be found in the *Revue Française* for January, 1910.*

Irrigation in South Africa.—The government of Cape Colony has published a detailed report entitled 'Proceedings of the First South African Irrigation Congress held at Robertson, Cape Colony, on May 18, 1909,' which reviews the progress and prospects of irrigation work in South Africa. The prime minister, the Hon. J. H. Merriman, in his inaugural address on the occasion, spoke of the paramount importance of the union of South Africa, and regarded irrigation as the most essential factor in building up the future of the countries; for favoured by nature as South Africa is in many ways, with a very fertile soil capable of yielding the best products under skill and energy, her great enemy is an arid climate in many parts, and every effort should be made to continue successful irrigation schemes. At present irrigation is largely confined to the Breede valley in the south-west, and to the great river-valleys of the midlands, but during the year 1908 irrigation schemes were taken in hand with an ultimate capacity of some 30,000 to 40,000 acres. The rainfall of Cape Colony averages 15 inches a year, and assuming a 5-per-cent. run off from its area of 276,000 square miles, a water-supply should be available for 3,000,000 acres of irrigation; but before this result can be obtained, more scientific methods of irrigation must become the rule. Moreover, the rainfall is very unevenly distributed, and much of the rainfall in the wet districts where irrigation is not needed could not be made available for the arid portions of the colony. The cost of bringing land under irrigation in South Africa is great, and schemes costing £10 an acre are the most common and financially sound. The amount of modern alluvial land suitable for flood irrigation is moreover limited, and on the uplands the depth of soil is insufficient for its adoption. In South Africa some system of water storage must largely form the basis of successful irrigation works. In the Transvaal the irrigation problem is greatly different from that in Cape Colony; in the latter country "flood" irrigation is prevalent, but in the former the heavier rainfall renders irrigation unnecessary when the rivers are in flood, and attention has to be directed towards the conservation of surplus water for use in dry periods.

Railway Construction in South-Central Africa.—The recent further extension northwards of the Rhodesian railway system into the Katanga district of the Congo Free State brings into prominence the possibility of the practical realization of the scheme for connecting this part of Central Africa with a port on the West Coast. It will be remembered that some years ago the Tanganyika Concessions, Limited, who own large mineral rights in the Katanga district, obtained from the late King of the Belgians the right to build a series of railway lines from Lobito bay into the Katanga district, which adjoins the northern boundary of North-Western Rhodesia. The construction of this railway system has already been commenced, and the line is already about 200 miles from Lobito bay. In the

* The regrettable news has just come to hand of the massacre, in Eastern Wadai, of Captain Fiegenschuh and several other French officers.

mean time, in Rhodesia the railway system was slowly being extended north from the Victoria falls towards the northern boundary of North-Western Rhodesia, which was crossed on December 11 last. There is still a large gap of some 700 or 800 miles to be bridged before railway communication between Rhodesia and the West Coast can be established, but no substantial agreement has been come to on the subject.

AMERICA.

The Pine Trees of Arizona in Relation to Weather Cycles.—An original paper, by Prof. A. E. Douglass, of singular interest, entitled "Weather Cycles in the Growth of Big Trees," appeared in the *Monthly Weather Review* for June, 1909. In a series of curves, the author exhibits a relationship between the variations of the growth of the pines as revealed by a study of the wood rings, and periodicities in the behaviour of temperature and rainfall, which in turn he attempts to correlate with variations of solar activity according to sun-spot frequency. The area considered is the State of Arizona, which, though situated in a low latitude, has a somewhat cold climate due to great altitude. The northern portion of Arizona consists mainly of a great plateau at an average elevation of 6000 feet above sea-level. This region is buried under several feet of snow in winter, and the summer nights are seldom warm enough for sitting out of doors. The San Francisco heights, near Flagstaff, are covered with forests of yellow pine (*Pinus ponderosa*), and these trees are wildly and elegantly scattered over the hills and plains of Arizona. There is a remarkable absence of undergrowth, and in the arid climate of Arizona the chief struggle of the trees is against drought. The author was led, in 1901, to investigate the subject from the consideration that the rings of a tree measure its food-supply, which is largely dependent upon the supply of moisture, and that in a dry climate with little interference from competing vegetation the relationship between the rate of growth of trees and the supply of moisture might be *discovered*. The average age as indicated by the rings of some twenty-five trees selected for study was 324 years. The main results of the investigation, which should be further pursued, may be summarized thus :—(1) The annual tree growth becomes a very close measure of the annual precipitation in the vicinity of the trees. (2) The following periodic variations exist: In tree growth, (*a*) 32·8 years; (*b*) 21·2 years; (*c*) 11·3 years; in weather elements (temperature and rainfall), (*d*) 11·3 years. (3) The 11·3-year period seems to be connected with changes in the output of solar energy; and as the amount of variation in tree growth associated with the 32·8-year period is very great, reaching 25 per cent. above and below the average, while that associated with the 21·2-year period only reaches 7 per cent., and the 11·3-year period 3 per cent., it seems very probable that the cause of the longer variations is to be sought in solar changes of greater magnitude than those revealed by the 11·3-year period.

Expeditions in South America.—The following items respecting expeditions in the field or contemplated in various parts of South America have lately come to hand. Baron Erland Nordenskiold, who gave the Society the results of a former expedition to the centre of South America in 1906, has returned from a new expedition, undertaken in 1908, to some of the least-known parts of eastern Bolivia, the primitive tribes of which he has studied with success. In the Andean region, the expedition under Dr. W. C. Farabee, referred to in vol. **29**, p. 229, and vol. **32**, p. 533, has completed its labours, returning to the United States last autumn. An interesting piece of work has been done in Central Brazil by a lady traveller, Miss Snethlage (of the Goeldi Museum at Para), in the crossing overland from the Xingu to the Tapajos by a route through country hitherto quite unmapped. The journey was accomplished last summer in the company of Indians,

a tributary of the Xingu being ascended, and a granite range some 1500 feet high crossed to the headwaters of a stream flowing to the Tapajos. Further east, a German traveller, Dr. Kissenbarth, has ascended the Araguaya to Bananal island, making studies of the little-known Indian tribes who inhabit the forests on its banks. Of projected expeditions, the most important is that of Dr. Fritz Reichert and other scientists, who left Buenos Aires at the end of 1909 for the purpose of carrying out a careful survey of the little-known Juncal *massif* in the Andes south of Aconcagua. Besides making ascents of the peaks, the explorers will pay special attention to the glacial features, which appear to be particularly well developed in this group.

AUSTRALASIA AND PACIFIC ISLANDS.

Surveys in New Zealand.—The Geological Survey Office of New Zealand issued in 1908 the second annual report (C–9), dealing with the geology and, to a great extent, also with the topography of several divisions of the Dominion. The report contains a map showing the survey districts and some fine illustrations of mountains and glaciers. The Parapara subdivision, Karamea, Nelson, South Island, has little of special geological interest, but is remarkable from the point of view of physiography and scenery, the area between the Karagarua and Landsborough rivers being particularly striking. The Great Douglas glacier, of which there is an excellent photograph in the report, consists of two distinct parts—the glacier proper or valley portion, and the *névé* portion. The two parts are separated by a rock precipice over 1000 feet high, above which rises a solid ice-cliff forming the southern face of the *névé*. Immense avalanches descend every few minutes from the face of the *névé* over the rock precipice, and these are the principal feeders of the valley portion of the glacier. There are comparatively few large crevasses in the surface of the Douglas *névé*, though there is one large "bergschrund" round the eastern base of Mount Sefton, but thirty-three streams issue from beneath the Douglas *névé* and descend abruptly as waterfalls. The surface of the valley portion, on the other hand, is much broken by crevasses and stacked with moraines, and the soft snow and ice composing it are coloured greenish by comminuted serpentinous rock derived from heights to the northward. Many of the subdivisions and districts of the survey afford considerable economic interest, yielding gold, copper, coal, petroleum, and other mineral products. In the Whatatu subdivision of Raukumara, Hawke's bay, North Island, the chief mineral is petroleum, surface indications of which are conspicuous at Waitangi hill, at the head of the Te Hau-o-te-Atua stream. A small branch of this stream, named Petroleum creek, contains pools through which petroleum gas emanates, leaving a thin coating of oil on the surface of the water, the surrounding soil being saturated with oil, to procure which test-pits have been sunk by various companies.

Exploration in New Guinea.—We regret to record the death, from drowning, of Mr. W. Stalker, a member of the British expedition to western New Guinea, who, as already mentioned in the *Journal*, had proceeded in advance of the rest of the expedition for the purpose of collecting carriers. Mr. Stalker, who was a native of Ambleside, had previously done some good collecting work for the British Museum. The Dutch expedition to the same part of the island, under Mr. A. H. Lorentz (*Journal*, vol. 34, p. 683), has, according to news received in Holland by telegraph during February, succeeded in ascending a portion of the interior snowy range, reaching the first glacier at a height of 15,000 feet. Mr. Hellwig has continued the survey of the Digul river, somewhat further east, and a party under Captain Weber last year succeeded in pushing across to within a short distance of the Fly river. A new snowy peak, to which the name Juliana was

given, is said to have been sighted from the highest point on the Digul. Some further details as to the programme of the expedition under Dr. Schultze (*Journal*, vol. 34, p. 683), for the survey of the boundary between German and Dutch New Guinea, are given in *Petermanns Mitteilungen*, No. 2, 1910. Besides the actual surveys, it is hoped to do other work in furtherance of our knowledge of this part of New Guinea. The first piece of survey-work to be undertaken will be the examination of the Tami river, which enters the sea just west of the international boundary.

POLAR REGIONS.

Dr. Charcot's Antarctic Expedition.—The French Antarctic Expedition under Dr. Jean Charcot arrived at Punta Arenas on board the *Pourquoi Pas?* on February 11. The following telegram, despatched by Dr. Charcot to Madame Charcot, has been communicated to us: "I think I have fulfilled, as far as my means would allow, the scientific problem which was set us by the Academy of Sciences. After running aground rather badly, we continued towards the south-west the survey of the coast of the Antarctic regions, begun during our former expedition, as far as Adelaide island—a very curious island 130 kilometres (about 81 miles) in length. To the south we discovered a vast gulf, and surveyed 120 miles of new country. We then reached Alexander I. Land, which was the principal goal of our expedition. Adjoining the land was a great deal of ice; the coast was ironbound, and there was no anchorage. Afterwards, returning north, we wintered at Petermann island. The winter was comparatively mild, but trying. The weather was frightful; we suffered considerably, and had several on the sick-list, who are now recovered. Numerous interesting excursions were made, especially on the glaciers. The second campaign included researches among the South Shetlands, notably on Deception and Bridgman islands. Then we again turned south, discovered a new island, and located Peter I. island. We sailed between the 69th and 71st parallels as far as 126° W. long. We hoped to do more, but have done the best we could." According to the map compiled by Dr. Charcot after his former expedition, Petermann island is situated in about 65° 10′ S. lat., 64° 5′ W. long. Other telegrams report that during the winter the members of the expedition were attacked by scurvy, and that the ship was damaged in collisions with icebergs. Both food and coal ran short. New lands were discovered west and south of Alexander I. Land. The ice conditions were unfavourable for the use of the motor-sledges carried by the expedition.

United States South Polar Expedition.—Early in February Commander Peary extended to the National Geographic Society of Washington, on behalf of the Peary Arctic Club, an invitation to co-operate with the club in the organization of a United States South Polar Expedition. This invitation has been accepted by the National Geographic Society. The Peary Arctic Club will contribute the use of the steamer *Roosevelt*, and the National Geographic Society the first £10,000 of the cost of the expedition; beyond that amount the expenses will be borne equally by the two bodies. Commander Peary has contributed personally a sum of £2000, which had been subscribed as a testimonial to him by some of his admirers. It is proposed that the expedition shall sail from the United States towards the end of this year, and establish a base on the opposite side of the Antarctic region to Captain Scott's proposed base in McMurdo sound. This would seem to indicate Coats Land as the base of the American expedition. The attempt to reach the South Pole will be made in the Antarctic summer of 1911–12, when Captain Scott will also be engaged in his attempt to reach the pole. It is understood that Captain Bartlett will again be in command of the *Roosevelt*. Commander Peary will not himself accompany the expedition. Letters which have passed

between him and Captain Scott have been published, and serve to show that the two expeditions will be conducted in a spirit of friendly international rivalry. Captain Scott suggests that there should be co-operation in matters of meteorology and magnetism. A programme might be drawn up which would enable simultaneous observations to be taken by the two expeditions.

Other Proposed Expeditions to the Antarctic Regions.—The announcement was made towards the end of January that, at the suggestion of Dr. H. F. Osborn, the U.S. Department of Commerce and Labour had under consideration the despatch of the government steamer *Albatross* to Antarctic waters for investigations with a commercial as well as a scientific object. It is hoped to discover the haunts of the southern fur seal in some of the remote island groups in or near the Antarctic region; but a study of the southern fauna generally would also be kept in view. Another scheme lately set on foot in America, without, however, apparently coming very near practical realization, is one for an expedition to Wilkes Land for the purpose of verifying Wilkes' discoveries, especially with regard to the continental nature of the lands seen by him in the far south. The idea was started by Mr. E. S. Balch, who on several occasions has come forward as a champion of Wilkes when his discoveries have been called in question, and who set forth the reasons "Why America should re-explore Wilkes Land" in the *Proceedings of the American Philosophical Society*, No. 191, 1909. The Geographical Society of Philadelphia has since, by a unanimous resolution, expressed its approval of the scheme, urging that a suitable vessel should be fitted out under the direction of the Secretary of the Navy. There is no doubt that Wilkes Land would offer a most promising field for an exploration such as is suggested.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

A New Cartographical Instrument.—We are informed that, under the name stereo-autograph, a new instrument was brought into use at the Military Geographical Institute at Vienna in December last. The instrument, which had been under construction by the firm of Zeiss, of Jena, since 1908, after the design of Lieut. E. Ritter von Orel, is intended to facilitate the utilization of stereoscopic views of country taken by means of a field photo-theodolite. It not only renders possible the automatic laying down of contour-lines, but also permits the determination of the position and altitude of any given point, as well as the plotting of any line visible in the picture in exactly the course actually followed by it. Experiments made with the instrument have given results entirely satisfactory in every respect. A detailed description of the instrument and of the results of the experiments is promised at a later date.

Glacial Erosion.—Prof. de Martonne has lately been studying the indications, near the lower ends of glaciers in the Alps in course of retreat, which might help to the solution of the question of glacial erosion. In the *Comptes Rendus* for December 27, 1909, he points out that the bed of glaciers near their termination generally shows a more or less steep incline, largely left bare at the present day, and a relatively level flat covered only at times of maximum extension of the glacier. It is on the latter chiefly that the striæ and other marks of glacial erosion are observable, the steeper slope showing rather the effects of torrential action. Following this up, he finds that in other parts of the glacier the marks of glacial erosion become more frequent where the inclination of the bed becomes less, a fact which is to be explained, in his view, by the closer contact between the ice and its bed at spots where the slope is less. He considers that a general law of an unequal incidence of glacial erosion may thus be formulated, and that a mechanical

impossibility is involved equally by the theories of those who deny, and of those who exaggerate, the effect of glacial erosion.

GENERAL.

The Oceanographical Museum at Monaco.—The inauguration of this museum, founded by the Prince of Monaco as an aid to oceanographical research, will take place, with appropriate ceremonies, on March 29 of this year. Various meetings and conferences will be held, lasting altogether till the evening of April 1.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1909–1910.

Seventh Meeting, January 24, 1910.—Major LEONARD DARWIN, President in the Chair.

ELECTIONS.—*Orie Bates; Colonel Edward Hugh Bethell, R.E.; Thomas Breakell; Samuel Carlisle; William Frederick Collins; Walter William Crawford; Lieut. C. M. D. Enriquez* (21*st Punjabis*); *John Hatfield; Rev. F. Nicholson Heazell; Lieut. Albert Edwin House, R.N.; Hermann Robert Jaeger; Francis Edgar Karithack; Major A. B. Longden* (37*th Dogras, I.A.*); *Theodore Lyman; Harry D. A. Maidment; Commander Harry Cutfield Martin, R.N.; William M. Pearce; Captain G. D. Pike* (9*th Gurkhas*); *Dr. Du Riche Preller, M.A.; George Frederick Riches; Harvey B. Robarts; John Graham Robertson; Commander T. E. Rogers* (*R.M.S. "Ecuador"*); *Eric Piero Shakerley; Sir Henry Babington Smith, K.C.B.; Captain L. D. Spencer* (*Egyptian Army*); *Orlando Sumner; Lieut. G. Tomes* (53*rd Sikhs*); *William Aubrey Willes.*

The PRESIDENT said: Before proceeding to the business of the evening, I have to announce that the Council of this Society has to-day decided to award a special Gold Medal to Commander Peary for having been the first human being to lead a party of explorers to a pole of the Earth, and also for having taken all the scientific investigations the circumstances of his travels permitted; and that also a silver replica of this medal will be awarded to Captain Bartlett, the Englishman who accompanied him to 88° N. latitude.

The paper read was:—

"A Journey in North-Western Arabia." By Douglas Carruthers.

RESEARCH DEPARTMENT.

January 20, 1910.—Dr. A. STRAHAN in the Chair.

"Sand dunes of the Libyan Desert." By H. J. L. Beadnell.

Eighth Meeting, February 7, 1910.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*William Aitken; Sir Hugh Shakespear Barnes, K.C.S.I., K.C.V.O.; Walter L. Buxton; Guy F. Cobbold; P. T. Etherton; Terrick Charles Fitz Hugh; G. Alfred Hancock; William John Leonard; Rev. Douglas McLellan; Major Richard Power O'Shee, R.E.; Herbert Phillips; Major Frank Renwick* (40*th Pathans*); *Samuel Edward Tench.*

The paper read was:—

"The Geographical Conditions affecting the Development of Australia." By Prof. J. W. Gregory, F.R.S.

LECTURES ON WAVES IN WATER, SAND, AND SNOW.

By Dr. VAUGHAN CORNISH.

First Lecture, Thursday, February 3, 1910.

On Ocean Waves, and on "Bores" in Rivers.

Second Lecture, Thursday, February 10, 1910.

On Waves in Sand.

Third Lecture, Thursday, February 17, 1910.

On Progressive Snow-waves, and on other Surface Forms of Snow.

LECTURE.

February 25, 1910.

Journey down the Mackenzie River to the Arctic Ocean. By Miss AGNES DEANS CAMERON.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und koniglich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo, quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Communications. *Deutsche Rundschau G.* 31 (1909): 481–493. **Meinhard.**
Die Verkehrswege über die Alpen, deren handelspolitische und militär-strategische Bedeutung. Von Friedrich Meinhard. *Map and Illustrations.*

Alps—Inn Valley. *Z. Gletscherkunde* 3 (1909): 52–67, 111–142. **Ampferer.**
Ueber die Entstehung der Inntal-Terrassen. Von Dr. O. Ampferer. *Sections and Illustrations.*

Alps—Valleys. *Z. Gletscherkunde* 3 (1909): 148–156. **Crammer.**
Zur Frage ineinander geschalteter Taltröge in den Alpen. Von Hans Crammer. Erwiderung. Von Hans Hess.

Alps, Eastern—Glaciation. **Hauptmann and Heritsch.**
Sitzb. K.A.W. Wien, I. Abt. 117 (1908): 405–437.
Die eiszeitliche Vergletscherung der Bösensteingruppe in den Niedern Tauern. Von Dr. Ludmil Hauptmann und Dr. Franz Heritsch. *Sketch-map and Diagrams.*

Alps, Eastern—Glaciers. *Z. Gletscherkunde* 3 (1909): 334–346. **Marinelli.**
Il limite climatico delle nevi nel gruppo del M. Canin (Alpi Giulie). Di Olinto Marinelli. *Sketch-map and Illustrations.*

Alps, Eastern—Phytogeography. **Beck.**
Sitzb. K.A.W. Wien, I. Abt. 116 (1907): 1439–1534; 117 (1908): 463–511.
Vegetationsstudien in den Ostalpen; I. and II. Teile. Von Günther Ritter Beck v. Mannagetta und Lerchenau. *Maps.*

Alps, Eastern—Surveys. *Sitzb. K.A.W. Wien, I. Abt.* 117 (1908): 371–404. **Becke.**
Bericht über die Aufnahmen am Nord- und Ostrand des Hochalmmassivs. Von F. Becke. *Sketch-map and Sections.*

Austria—Carinthia. *Deutsche Rundschau G.* 31 (1909): 289–299, 350–357. **Perko.**
Ein geschichtlicher Rückblick auf die Innerkrainer Höhlen und eine kurze Beschreibung derselben. Von G. And. Perko. *Plan and Illustrations.*

Belgium—Place-names. *Deutsche Erde* 8 (1909): 99–104, 139–143. **Warker.**
Die deutschen Orts- und Gewässernamen der belgischen Provinz Luxemburg. Von Prof. Nikolaus Warker. *Map.*

Central Europe—Slovenes. **Peisker.**
Die ältere Sozial- und Wirtschaftsverfassung der Alpenslawen (Slowenen). Gegen Prof. D. Alphons Dopsch, von J. Peisker. (Sonderabdruck aus der Vierteljahrschrift für Social- und Wirtschaftsgeschichte, 7 Bd.) Stuttgart, 1909. Size 8½ × 5½, pp. 14.

Denmark—Bornholm. *XI. Jbericht G. Ges. Greifswald*, 1907–08 (1909): 163–200. **Braun.**
Ueber die Morphologie von Bornholm. Von Dr. G. Braun. *Maps, Sections, and Illustrations.*
See February number, p. 193.

Denmark—Pilot. ———
Den Danske Havne-Lods; udgivet af det Kongelige Søkort-Arkiv. Sjette Udgave; sluttet den 1st August, 1909. Copenhagen, 1909. Size 10 × 6½, pp. 152. *Plans. Price* 2 *kr. Presented by the K. Danske Søkort-Arkiv.*

Europe—Waterways. **Lindley.**
Royal Commission on Canals and Waterways. Vol. 6. Foreign Inquiry, Report on the Waterways of France, Belgium, Germany, and Holland. By W. H. Lindley. Part I.—Reports and Appendices. Part II.—Maps and Tables. London: Wyman & Sons, 1909. Size 13 × 8½, pp. xii. and 224. *Maps.*

France—Landes. *B.S.G. Comm. Bordeaux* 32 (1909): 217–222. **Bergon and Lalesque.**
Preuves géologiques et biologiques de l'origine marine du lac de Cazaux. Par Paul Bergon et Dr. F. Lalesque.

France—Marseilles. **Léotard.**
Notice sur Marseille et les Bouches-du-Rhône. Le Département. Marseille: Le Port—La Cité. Aix. Arles. Par Jacques Léotard. Marseille, 1909. Size 10½ × 7, pp. 24. *Illustration. Presented by the Author.*

France—Mountain-Economy. *B.S.G. Comm. Bordeaux* 32 (1909): 109–122. **Descombes.**
La première étape de l'Association Centrale pour l'Aménagement des Montagnes. Par P. Descombes.

France—Rochefort. *B.S.G. Rochefort* 31 (1909): 156–166. **Bugard.**
Rochefort-sur-Mer, ses rades et son port. Par le vice-amiral Bugard.

Germany—Bavaria. **Schulze.**
Beiträge zur Landes- und Siedlungskunde des Fichtelgebirges. Inaugural-Dissertation . . . von Gustav Schulze. Borna (Leipsig), 1909. Size 9 × 6, pp. iv and 128. *Presented by the Author.*
See *ante*, p. 332.

Germany—Main basin. **Grubert.**
Forschungen deuts. Landes u. Volksk. 18 (1909): 1–102.
Die Siedelungen am Maindreieck. Von Dr. Adam Grubert. *Sketch-map and Section.*

Germany—Mecklenburg. **Schuls.**
Die Siedlungen des Warnowgebietes in Mecklenburg. Eine geographische Studie von Dr. Alfred Schuls. (Geographische Arbeiten, herausgegeben von Dr. Willi Ule: IV.) Stuttgart: Strecker & Schröder, 1909. Size 8½ × 6, pp. x. and 44. *Price* 2*m. Presented by the Publishers.*

Germany—Prussia—Röm. **Moritz.**
Veröffentl. I. f. Meereek. u. d. G.I. Universität Berlin, Heft. 14 (1909): pp. iv. and 72.
Die Insel Röm. Von Prof. Dr. Eduard Moritz. *Maps.*

Germany—Rhine basin. **Martiny.**
Forschungen deuts. Landes- u. Volksk. 18 (1909): 405–494.
Kulturgeographie des Koblenzer Verkehrsgebietes. Von Dr. Rudolf Martiny. *Maps.*
See February number, p. 193.

Germany—Volcanoes. *Naturw. Wochenschrift* 23 (1908): 769–777. **Reck.**
Die kainozoischen Vulkane Deutschlands und unsere Vulkantheorien. Von Hans Reck. *Sketch-map.*

Germany—Würtemberg. **Schen.**
Forschungen deuts. Landes- u. Volksk. 18 (1909): 361–404.
Zur Morphologie der Swäbisch-Fränkischen Stufenlandschaft. Von Dr. Erwin Schen. *Sketch-maps.*
See Monthly Record for January, p. 77.

Greece—Thessaly. *Deutsche Rundschau G.* 32 (1909): 12–19. **Mielert.**
Aus dem östlichen Thessalien. Von Fritz Mielert. *Illustrations.*

Hungary—Historical. *Abrégé B.S. Hongroise G.* 36 (1908): 162–180. **Szakáll.**
Ungarns westliche Grenze im Jahre 1254. Von Zsigmond Szakáll. *Sketch-map.*

Iceland. **Spethmann.**
Der Aufbau der Insel Island. Von Dr. Hans Spethmann. (Separatabdruck aus dem Centralblatt für Mineralogie, Geologie und Paläontologie, Jahrg. 1909, No. 20 u. 21.) Stuttgart, 1909. Size 9 × 6, pp. 16.

Iceland—Glaciers. *Z. Gletscherkunde* 3 (1909): 297–305. **Sapper.**
Bemerkungen über einige südisländische Gletscher. Von Prof. Dr. K. Sapper. *Sketch-maps and Illustrations.*

Iceland—Volcanoes. *Globus* 96 (1909): 201–205. **Spethmann.**
Beiträge zur Kenntnis des Vulkanismus am Mückensee auf Island. Von Dr. Hans Spethmann. *Sketch-map.*

Italy. *Atti R A Lincei, Rendiconti* 2 (1909): 401–409. ——
Messina e Reggio nella Storia

Italy—Seismology. *B.S.G. Marseille* 33 (1909): 1–16. **Repelin.**
L'Italie et ses Regions Sismiques. Les tremblementes de terre de l'Italie méridionale. Par M. J. Repelin *Diagram*

Russia—Finland. **Heinrichs and Korhonen.**
Observations météorologiques, publiées par l'Institut Météorologique Central de la Société des Sciences de Finlande. État des glaces et des neiges en Finlande pendant l'hiver 1896–1897; Exposé par Axel Heinrichs et V. V. Korhonen (pp. 58). Ditto, pendant l'hiver 1897–1898; Exposé par V. V. Korhonen (pp. 60) Helsingfors, 1908–1909. Size 13½ × 10. *Maps.*

Russia—Runö. *Globus* 96 (1909): 181–186. **Krah**
Die Insel Runö und ihre Bewohner. Von Carl Krah. *Illustrations.*

Russia—Ural. **Duparc and others.**
Mém. S. Phys. et d'Hist. Nat. Genève 36 (1909): 33–208.
Recherches géologiques et pétrographiques sur l'Oural du Nord. Le bassin de la haute Wichéra. Par Louis Duparc, Francis Pearce, et Marguerite Tikanowitch. *Sketch-map, Plans, Sections, and Illustrations.*

Russia—Ural. *B.S.G. Lyon*, Ser. II. 1 (1908): 129–149. **Offret.**
L'Oural au point de vue minier et métallurgique. Par A. Offret.

Southern Europe—Karst. *G.Z.* 15 (1909): 185–204, 259–281. **Sawicki.**
Ein Beitrag zum geographischen Zyklus im Karst. Von Ludomir Ritter von Sawicki. *Sections and Illustrations.*

Switzerland—Bern—Caverns. **Heim.**
Vierteljahrsschrift Naturforsch. Ges. Zürich 54 (1909): 52–58.
Ueber die Beatus-Höhlen am Thunersee. Von Arnold Heim. *Plan and Sections.*

Switzerland—Föhn. *Met. Z.* **26** (1909): 165–170. **Maurer.**
Aus langjährigen Aufzeichnungen des Schweizer Föhns. Von J. Maurer. *Sketch-map.*

Switzerland—Lake of Zug. **Nussbaumer.**
Vierteljahrsschrift Naturforsch. Ges. Zürich **54** (1909): 1–51.
Ueber die Verunreinigung von Seen durch Einleitung städtischer Abwässer mit spezieller Berücksichtigung des Zugersees. Von Th. Nussbaumer. *Plan.*

Switzerland—Zürich—Relief. **Hellmund.**
Vierteljahrsschrift Naturforsch. Ges. Zürich **54** (1909): 149–216.
Die Drumlinlandschaft zwischen Pfäffiker- und Greifensee (Kanton Zürich). Von Hermine W. Bodenburg Hellmund. *Maps and Sections.*

Turkey—Albania. **Ippen.**
Skutari und die nordalbanische Küstenebene. Von Theodor A. Ippen. (Zur Kunde der Balkanhalbinsel . . . herausgegeben von Dr. Carl Patsch. Heft 5.) Sarajevo: D. A. Kajon, 1907. Size 9 × 6, pp. iv. and 84. *Illustrations. Price* 2.50*m.*

ASIA.

Central Asia. *M. k.k. G. Ges. Wien* **52** (1909): 289–324. **Stein.**
Geographische und archäologische Forschungsreisen in Zentralasien 1906–1908. Von M. Aurel Stein. *Illustrations.*

Central Asia—Anthropogeography. *G.Z.* **15** (1909): 241–258. **Cholnoky.**
Kunstliche Berieselung in Inner-Asien und die Völkerwanderung. Von Jenö v. Cholnoky.

China—Great Wall. **Geil.**
The Great Wall of China. By William Edgar Geil. London: J. Murray, 1909. Size 9 × 6, pp. xviii. and 352. *Sketch-map, Plan, and Illustrations. Price* 21*s. net. Presented by the Publisher.*

China—Kiang-su. *M. Seminars Oriental. Sprachen* **12** (1909): 157–198. **Tschepe.**
Das chinesische Holland in Mittelchina. Eine geographisch-geschichtliche Studie von P. Albert Tschepe.

Dutch East Indies. *Ts. K. Nederlandsch Aard. Genoots.* **26** (1909). 723–746. ———
De staatkundige indeeling van Nederlandsch-Indie. *Map.*

Dutch East Indies—Survey. **Rouffaer.**
Ts. K. Nederlandsch. Aard. Genoots. **26** (1909): 773–788.
Een bezoek aan de Topographische Inrichting te Batavia. Door G. P. Rouffaer.

French Indo-China—Archæology. **Lunet de Lajonquière.**
B. Ecole française Extrême-Orient **9** (1909): 351–368.
Rapport sommaire sur une mission archéologique au Cambodge, au Siam, dans la presqu'île malaise et dans l'Inde (1907–1908). Par E. Lunet de Lajonquière.

French Indo-China—Cochin China. **Philipon and Rey.**
B.S.G. Rochefort **31** (1909): 125–156.
Relation du second voyage, à la Cochinchine, du navire Henri, armé à Bordeaux par M. Philipon, et commandé par M. le capitaine Rey, pendant l'année 1819 et les trois premiers mois de 1820.

India—Bengal—Ethnology. **Bompas.**
Folklore of the Santal Parganas. Translated by Cecil Henry Bompas. London: D. Nutt, 1909. Size 9 × 5¾, pp. 484. *Price* 10*s.* 6*d. net. Presented by the Publisher.*

India—Himalaya. *A Travers le Monde* **15** (1909): 357–359. **Dupuy.**
L'Expedition du Duc des Abruzzes dans le Massif de l'Himalaya. Par E. Dupuy. *Sketch-map.*

India—Historical. **Fryer and Crooke.**
A new account of East India and Persia, being nine years' travels, 1672–1681. By John Fryer; edited . . . by William Crooke. Vol. I. (Works issued by the Hakluyt Society, Second Series, No. xix.) London, 1909. Size 9 × 5¾, pp. xl. and 354. *Facsimile Maps and Illustrations. Presented by the Hakluyt Society.*

India—Rajputana. **Holland and Christie.**

Records Geol. Surv. India **38** (1909): 154–186.

The Origin of the Salt Deposits of Rajputana. By Sir Thomas H. Holland and W. A. K. Christie. *Sketch-map.*

Japan—Formosa. *Smithsonian Misc. Coll.* **52** (No. 1860: 1909): 287–294. **Arnold.**

The Peoples of Formosa. By Julean H. Arnold. *Map and Illustrations.*

The writer's ascent of Mount Morrison was referred to in the Monthly Record for December (p. 679).

North Central Asia. *M.G. Ges. Jena* **27** (1909): 1–127. **Paquet.**

Südsibirien und die Nordwestmongolei. Von Mr. Alfons Paquet. *Maps and Illustrations.*

Malay Archipelago—Borneo. **Baring-Gould and Bamfylde.**

A history of Sarawak under its two white Rajahs, 1839–1908. By S. Baring-Gould and C. A. Bamfylde. London: H. Sotheran & Co, 1909. Size 9 × 6, pp. xxiv. and 460. *Map and Illustrations. Price* 15*s. net. Presented by the Publishers.*

Malay Archipelago—Jilolo. **Jongh.**

Ts. K. Nederlandsch Aard. Genoots. **26** (1909): 747–772.

De Oostkust van Noord-Halmahera. Door G. J. J. de Jongh. *Sketch-maps.*

AFRICA.

Africa—Historical. *Mouvement G.* **26** (1909): 376–378. **Wauters.**

L'Afrique centrale a-t-elle été decouverte au XVI^e^ siècle? Par A.-J. Wauters. *Map.*

Exposes once more the fallacy of the supposed exploration of the African interior in the sixteenth century.

Algeria—Denudation. *Geographische Z.* **15** (1909): 493–510. **Passarge.**

Verwitterung und Abtragung in den Steppen und Wüsten Algeriens. Von Siegfried Passarge. *Illustrations.*

Angola. *K. A. W. Amsterdam P. Sec. Sc.* **11** (1908): 88–109. **Sanders.**

Contributions to the determination of geographical positions on the west coast of Africa. III. By C Sanders.

Belgian Congo. *Mouvement G.* **26** (1909): 397–406. **Prince Albert.**

La traversée du Congo Belge. Par le Prince Albert de Belgique. *Portrait and Sketch-maps*

Belgian Congo—Ethnology. *B.S R. Belge G.* **32** (1908): 386–421, 429–450. **Delhaise.**

Ethnographie congolaise: Chez les Warundi et les Wahorohoro. Par Charles Delhaise. *Illustrations.*

These tribes dwell round the north and west of Tanganyika.

Belgian Congo—Ethnology. **Hutereau.**

Annales du Musée du Congo: Ethnographie et Anthropologie. Series III. Documents Ethnographiques concernant les Populations du Congo Belge. Tome i. Fascicule i. Notes sur la vie familiale et juridique de quelques populations du Congo Belge. Par A. Hutereau. Brussels, 1909. Size 14½ × 10½, pp. 1–104 and i–xii. *Maps and Illustrations.*

Canary Islands. **Brun.**

Le Chahorra (Iles Canaries). Par M. Albert Brun. (Extrait, l'Écho des Alpes, No. 10, Octobre, 1909.) Geneva, 1909. Size 9 × 5½, pp. 337–354. *Illustrations. Presented by the Author.*

The Chahorra is one of the subsidiary cones of the famous peak, the site of the eruption of 1798.

Canary Islands—Phytogeography. **Schenck.**

Beiträge zur Kenntnis der Vegetation der Canarischen Inseln. Von Dr. Schenck. (*W. Ergebnisse Valdivia-Expedition*, 1898–99 (*Chun*) **2** (1907): 1 Teil, 225–406.) *Maps and Illustrations.*

Canary Islands—Phytogeography. **Schröter.**

Eine Exkursion nach den canarischen Inseln. Von Dr. C. Schröter. Zürich: Rascher & Cie., [1909]. Size 9 × 6, pp. 66. *Illustrations. Price* 4*s.*

Cape Colony—Ground-level. *Trans. R.S. South Africa* I. (1909): 303–310. **Sutton.**

Preliminary note on the Diurnal Variation of Level at Kimberley. By J. R. Sutton.

Central Africa. **Mecklenburg.**

Ins innerste Afrika. Von Adolf Friedrich Herzog zu Mecklenburg. Bericht über den Verlauf der deutschen wissenschaftlichen Zentral-Afrika-Expedition 1907–1908. Leipzig: Klinkhardt und Biermann, 1909. Size 10 × 7, pp. xii. and 476. *Maps and Illustrations. Price* 14*m. Presented by the Publishers.*

Central Africa—Geodesy. *R. Engineers J.* 10 (1909): 209–220. **Jack.**

Measurement of the Semliki Base: with some notes on Invar Wires. By Captain E. M. Jack.

Central Africa—Phytogeography. **Mildbraed.**

Sitzb. K. Preuss. A.W. Berlin (1909): 989–1017.

Die Vegetationsverhältnisse der centralafrikanischen Seenzone vom Viktoria-See bis zu den Kiwu-Vulkanen. Bericht über die botanischen Ergebnisse der Expedition des Herzogs Adolf Friedrich zu Mecklenburg 1907–1908. Von J. Mildbraed.

East Africa. **MacQueen.**

In wildest Africa: the record of a hunting and exploration trip through Uganda, Victoria, Nyanza, the Kilimanjaro region, and British East Africa, with an account of an ascent of the snowfields of Mount Kibo, in East Central Africa, and a description of the various native tribes. By Peter MacQueen. Boston: L. C. Page & Co., 1909. Size 8 + 5½, pp. xiv. and 402. *Sketch-map and Illustrations. Presented by the Author.*

Egypt—Minerals. *Cairo Sc. J.* 3 (1909): 181–185. **Thomas.**

The Mineral Industry of Egypt. By A. E. Thomas. *Maps, Plan, and Sections.*

Egypt—Nile. *Cairo Sc. J.* 3 (1909): 209–213. **Dowson.**

A Consideration of the Magnitude of the Nile Flood in 1908. By E. M. Dowson. *Diagram.*

Egypt—Nile. **Dowson and Craig.**

Ministry of Finance, Egypt. Survey Department, Paper No. 11. Measurement of the Volumes discharged by the Nile during 1905 and 1906. By E. M. Dowson, with a note on Rating Formulæ for Current-meters, by J. I. Craig. Cairo, 1909. Size 10½ × 7, pp. 82. *Sketch-map, Plan, Diagrams, and Sections. Presented by the Director-General.*

Noticed in the Monthly Record (vol. 34, p. 680).

Egypt—Roda Island. *B.S. Khédiviale G.* 7 (1909): 151–164. **Abbate.**

L'île de Rodah. Par Abbate Pacha. *Plans and Illustrations.*

Egypt—Sinai. *Cairo Sc. J.* 3 (1909): 155–161. **Weldon.**

Six Months in Northern Sinai. By L. B. Weldon. *Illustrations. Also separate copy*, size 10½ × 7, pp. 8.

Egypt—Surveys. *Cairo Sc. J.* 3 (1909): 218–224. **Crosthwaite.**

Survey Work in Lower Nubia, 1908-1909. By W. H. Crosthwaite.

Egypt—Surveys. ———

Ministry of Finance, Egypt. Survey Department. A Report on the Work of the Survey Department in 1908. Cairo, 1909. Size 10½ × 7, pp. 88. *Sketch-maps. Presented by Director-General.*

Egypt and Sudan—Evaporation. **Keeling.**

Ministry of Finance. Egypt. Survey Department, Paper No. 15. Evaporation in Egypt and the Sudan. By B. F. E. Keeling. Cairo, 1909. Size 10½ × 7½, pp. 30. *Presented by the Director-General.*

Eritrea. *L'esplarazione Com.* 24 (1909): 135–146, 164–176, 206–217, 235–245. **Odorizzi.**

La Dancalia italiana del Nord. Per D. Odorizzi.

French Congo. *B.S.G. Com. Havre* 25 (1908): 201–219; 26 (1909): 13–27. **Moll.**

Forêt et Savanes Congolaises. Par Commandant Moll.

French Guinea—Ethnology. **Guebhard.**

Rev. Études Ethnograph., Paris 2 (1909): 85–108.

Les Peulh du Fouta Dialon. Par Paul Guebhard. *Illustrations.*

French West Africa—Dahome. **Bartet.**

Les rois du Bas-Dahomey. Par Dr. A. Bartet. (Extrait du *Bulletin de la Société de Géographie de Rochefort*, 1908.) Rochefort, 1908. Size 10 × 6½, pp. 88. *Presented by the Author.*

German Colonies. **Meyer.**

Das Deutsche Kolonialreich, eine Länderkunde der deutschen Schutzgebiete . . . herausgegeben von Prof. Dr. Hans Meyer. I. Band: Ostafrika und Kamerun. Leipzig, etc., Bibliographische Institut, 1909. Size 10 × 7, pp. xii. and 650. *Maps and Illustrations. Price* 15*m. Presented by the Publishers.*

German Colonies—Agriculture. *Koloniale Z.* 9 (1908): 319–321. **[Kolbe.]**

Die Einführung der Pflugkultur in die Wirtschaft des Negers in Togo und Deutschostafrika. Von Oberleutnant a. D. F[ranz] Ko[lbe].

German East Africa. *Globus* 95 (1909): 309–312; 325–328. **Diesing.**

Eine Reise in Ukonongo (Deutsch-Ostafrika). Von Dr. Ernst Diesing.

German East Africa—Kilimanjaro. **Jaeger.**

Forschungen in den Hochregionen des Kilimandscharo. Von Dr. Fritz Jaeger. (Sonderabdruck aus *Mitteilungen aus den Deutschen Schutzgebieten*, Band xxii., 1909.) Berlin, 1909. Size 12½ × 9½, pp. 114–198. *Maps, Sections, and Illustrations. Presented by the Author.*

Dr. Jaeger's researches on Kilimanjaro were referred to in vol. 29, p. 457.

German South-West Africa. *Deutsches Kolonialblatt* 20 (1909): 1004–1006. **Rappard.**

Durch die Namib nach Lüderitzbucht. Bericht des Hauptmanns v. Rappard. *Map.*

NORTH AMERICA.

Alaska. **Covert and Ellsworth.**

U.S. Geol. Surv., Water Supply Paper, No. 228 (1909): pp. 108.

Water-Supply Investigations in the Yukon-Tanana Region, Alaska. 1907 and 1908. Fairbanks, Circle, and Rampart Districts. By C. C. Covert and C. E. Ellsworth. *Maps, Illustrations, and Diagrams.*

Alaska—Glaciers. *Z. Gletscherkunde* 3 (1908): 81–110. **Tarr.**

Some phenomena of the glacier margins in the Yakutat Bay region, Alaska. By Ralph S. Tarr. *Sketch-map and Illustrations.*

British Guiana. **Bayley.**

Handbook of British Guiana, 1909. Comprising general and statistical information concerning the colony Edited and compiled by Geo. D. Bayley. Georgetown (London Dulau & Co.), 1909 Size 8½ × 5½, pp. xxvi. and 608. *Map and Illustrations. Price* 5*s Presented by the Publishers.*

Canada. ———

Department of the Interior. Report of the Chief Astronomer for the year ending March 31, 1907 Ottawa, 1908. Size 10 × 6½, pp. 258. *Illustrations and Diagrams.*

Appendices deal *inter alia* with gravity, magnetic, and latitude and longitude observations.

Mexico—Oaxaca *J. Franklin I.* 168 (1909): 200–215. **Birkinbine.**

The Mixteca country in the State of Oaxaca, Mexico. By John Birkinbine. *Illustrations.*

Mexico—Tehuantepec. *B.S Mexicana G.* 3 (1909): 165–179. **Castellanos.**

Breves apuntes sobre Geologia y Climatologia del Istmo de Tehuantepec. Por E. Maqueo Castellanos

Mexico—Volcanoes. *Abrégé B.S. Hongroise G.* 36 (1908): 151–161. **Inkey.**

Des volcans du Méxique. Par B. de Inkey. *Illustrations.*

North America—Geology. *U.S. Geol. Surv., B.* 360 (1909): pp. 940. **Hise and Leith.**

Pre-Cambrian Geology of North America. By Charles Richard Van Hise and Charles Kenneth Leith. *Maps.*

United States—Colorado. **Fewkes.**

Bureau of American Ethnology. Bulletin 41. Antiquities of the Mesa Verde National Park. Spruce-tree House. By Jesse Walter Fewkes. Washington, 1909. Size 9 × 6, pp. 58 *Plan, Diagrams, and Illustrations.*

United States—Geodesy. **Hayford.**

[U.S.] Coast and Geodetic Survey. Geodesy. The Figure of the Earth and Isostasy from Measurement in the United States. By John F. Hayford. Washington, 1909. Size 11½ × 9, pp. 178. *Sketch-maps and Diagrams.*

United States—Magnetism. **Faris.**

Department of Commerce and Labor. Coast and Geodetic Survey. Terrestrial Magnetism. Results of Magnetic Observations made by the Coast and Geodetic Survey between July 1, 1907, and June 30, 1908. By E. L. Faris. Appendix No. 3. Report for 1908. Washington, 1909. Size 11½ × 8, pp. 71–166.

United States—Minerals. **Campbell and others.**

U.S. Geol. Survey, B. 341 and 380 (1909): pp. 444 and 406.

Contributions to Economic Geology, 1907. Part II. Coal and Lignite. By Marius R. Campbell. Ditto, 1908. Part I. Metals and Non-Metals, except Fuels. By C. W. Hayes and Waldemar Lindgren. *Maps, Plans, and Diagrams.*

United States—Minerals. *U.S. Geol. Surv., B.* 394 (1909): pp. 214. **Various authors.**

Papers on the conservation of Mineral Resources. By Various Authors. *Maps, Diagrams, and Illustration.*

United States—Minnesota. *American J. Sc.* 27 (1909): 388–392. **Griggs.**

Divided Lakes in Western Minnesota. By Robert F. Griggs. *Illustrations.*

Noticed in the January number, p. 81.

CENTRAL AND SOUTH AMERICA.

Andes. *American J. Sc.* 28 (1909): 197–217; 373–402. **Bowman.**

The Physiography of the Central Andes. Part I. The Maritime Andes; Part II. The Eastern Andes. By Isaiah Bowman. *Sketch-maps, Diagrams, and Illustrations.*

Argentina—Antiquities. **Willenius**

Observaciones Arqueológicas sobre Alfareria Funeraria de la "Poma" (Valle Calchaqui—Provincia de Salta). Por J. A. Willenius. (De la Revista de la Universidad, tomo xi.) Buenos Aires, 1909. Size 10½ × 7, pp. 42. *Illustrations. Presented by the Author.*

Argentine—Archæology. **Quevedo.**

Tipos de Alfareria en la región Diaguito-Calchaqui. Por Samuel A. Lafone Quevedo. ('De la Revista del Museo de La Plata,' tomo xv. (segunda serie, tomo ii.), páginas 295 á 396.) Buenos Aires, 1908. Size 11 × 7½, pp. 295–396. *Sketch-maps and Illustrations. Presented by the Author.*

Argentine—Ethnology. **Quevedo.**

Etnologia Argentina. Por Samuel A. Lafone Quevedo. ('De la Universidad Nacional de La Plata en el IV° Congreso Científico (1° Panamericano),' páginas 176 á 215.) Buenos Aires, 1909. Size 11 × 7½, pp. 176–216. *Map. Presented by the Author.*

Bolivia—Anthropogeography. *B.G.S. Philadelphia* 7 (1909): 159–184. **Bowman.**

The Highland Dweller of Bolivia: an Anthropogeographic Interpretation. By Isaiah Bowman. *Illustrations.*

Bolivia—Economics.

Cuestiones Económicas y Financieras. (Articulos publicados en la revista ministerial de Hacienda é Industria.) La Paz, 1909. Size 9 × 6, pp. 222.

Brazil. *Sitzb. A.W. Wien* 116 (Abt. I.) (1907): 1111–1204. **Schuster and others.**

Petrographische Ergebnisse der brasilianischen Expedition 1901 der kais. Akademie der Wissenschaften. Von Dr. Karl Schuster. Mit einer geologischen Einleitung von Dr. Fritz v. Kerner und Bemerkungen über die Kristallinen Schiefer von F. Becke. *Sketch-maps.*

Some account of this expedition, organised primarily for botanical research in the mountain ranges of south-eastern Brazil, was given in the *Journal*, vol. 17, p. 195; vol. 18, p. 625.

Cuba—Demography. **Heape.**

The Proportion of the Sexes produced by Whites and Coloured Peoples in Cuba. By Walter Heape. (From the *Philosophical Transactions of the Royal Society of*

London, Ser. B, vol. 200.) London, 1909. Size 12 × 9¾ pp. 271–330. *Presented by the Author.*

West Indies—Cotton. **Watts.**

The British Cotton-growing Association. No. 35. West Indian Cotton Growing. By the Hon. Francis Watts. Manchester, 1909. Size 8½ × 5½, pp. 20. *Sketch-map.*

AUSTRALASIA AND PACIFIC ISLANDS.

Queensland—Exploration. *P.R.S. Queensland* **22** (1909): 1–22. **Norton.**

The Jardines' Expedition from Rockhampton to Cape York in 1864. By Hon. A. Norton.

Southern Ocean—Bouvet Island. **Sachse.**

Das Wiederauffinden der Bouvet-Insel durch die deutsche Tiefsee-Expedition. Von Kapt. W. Sachse. (*W. Ergebnisse "Valdivia" Expedition*, 1898–99 (*Chun*) **10** (1905): 1–34.) *Maps and Illustrations.*

Southern Ocean—Islands. **Reinisch.**

Gesteine von der Bouvet-Insel, von Kerguelen, St. Paul und Neu-Amsterdam. Von R. Reinisch. (*W. Ergebnisse "Valdivia"-Expedition*, 1898–99 (*Chun*) **10** (1908): 45–76.) *Illustrations.*

Southern Ocean—Islands. **Schenck.**

Vergleichende Darstellung der Pflanzengeographie der subantarktischen Inseln, insbesondere über Flora und Vegetation von Kerguelen. Von H. Schenck. (*W. Ergebnisse "Valdivia"-Expedition*, 1898–99 (*Chun*) **2** (1905): 1 Teil. 1–178.) *Map and Illustrations.*

Southern Ocean—St. Paul and New Amsterdam. **Schenck.**

Ueber Flora und Vegetation von St. Paul und Neu-Amsterdam. Von H. Schenck. (*W. Ergebnisse "Valdivia"-Expedition*, 1898–99 (*Chun*) **2** (1905): 1 Teil, 179–224.) *Illustrations.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geomorphology. *Z. Gletscherkunde* **3** (1909): 346–358. **Werth.**

Fjorde, Fjärde und Fohrden. Von Dr. Emil Werth. *Section and Illustrations.*

Geophysics. *J. Geology* **17** (1909): 344–350. **Gilbert.**

The Convexity of Hilltops. By G. K. Gilbert. *Diagram and Illustrations.*

Glacial Epoch. **Nölke.**

Neue Erklärung der Entstehung der irdischen Eiszeiten. Von Dr. Fr. Nölke. (Sonder-Abdruck aus den Abh. d. Nat Ver. Bremen, Bd. xx, Heft 1.) Bremen, 1909. Size 9 × 5½, pp 28.

Glacier Streams. *Z. Gletscherkunde* **3** (1909): 271–285. **Gogarten.**

Messungen der Schlammführung von Gletscherbächen. Von E. Gogarten. *Diagram.*

Kumatology. *Quart. J. R. Met. S.* **35** (1909): 149–161. **Cornish.**

Wind-waves in Water, Sand, Snow, and Cloud. By Dr. Vaughan Cornish. *Illustrations.*

Lakes and Climate. *Naturw. Wochenschrift* **8** (1909): 385–393. **Halbfass.**

Temperaturmessungen in tiefen Seen in ihrer Beziehung zur Klimatologie. Von Prof. Dr. Halbfass. *Diagrams*

Meteorology. *B.A. Imp Sc. St. Petersbourg* (1909): 745–764. **Rykachef.**

Observations faites dans les différentes couches de l'atmosphère durant le voyage de St. Petersbourg à Odessa à bord du bateau *Neptune* de la Compagnie Russe de Navigation et Commerce depuis le 9 (22) mai jusqu'au 30 mai (12 juin) 1908. Par M. M. Rykacev. *Diagrams.* [In Russian.]

Meteorology. *C.R.A. Sc. Paris* **148** (1909): 591–594. **Teisserenc de Bort.**

Lois de distribution de la température avec la hauteur aux diverses latitudes, et suivant les régimes météorologiques différents. Par L. Teisserenc de Bort. *Diagrams.*

Meteorology—Cloudiness. *Met. Z.* **26** (1909): 49–54, 201–209. **Steen.**

Einige Studien über die Bewolkung I.–III. Von Aksel S. Steen. *Diagrams.*

Meteorology—Historical. Hoffmann.
Münchener G. Studien (Günther) **23** (1907): pp. 96.
Die Anschauungen der Kirchenväter über Meteorologie: ein Beitrag zur Geschichte der Meteorologie. Von Immanuel Hoffmann.

Meteorology—Upper air. Gold and Harwood.
The Present State of our Knowledge of the Upper Atmosphere as obtained by the use of Kites, Balloons, and Pilot Balloons. Report of the Committee, consisting of Messrs. E. Gold and W. A. Harwood. (British Association, Section A, Winnipeg, 1909.) [London, 1909.] Size 8½ × 5½, pp. 54. *Diagrams.*

Meteorology—Upper air. *Met. Z.* **26** (1909): 241–258. Schmauss.
Die obere Inversion. Von A. Schmauss. *Diagrams.*

Meteorology—Water-circulation. *Quart. J.R. Met. S.* **35** (1909): 189 211. Latham.
Percolation, Evaporation, and Condensation. By Baldwin Latham. *Diagrams.*

Oceanography—Baltic. Abshagen.
XI. Jbericht G. Ges. Greifswald, 1907–08 (1909): 61–160.
Das Phytoplankton des Greifswalder Boddens. Von Gustav Abshagen. *Chart and Diagrams.*

Oceanography—Currents. *Ann. Hydrographie* **37** (1909): 254–261. Schiötz.
Zur Frage der durch den Wind erzeugten Meeresstromungen. Von O. E. Schiötz.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Agriculture. *Travel and Exploration* **2** (1909): 139–143. Fairchild.
A New Exploration of the World. By David Fairchild.
An account of agricultural exploration under the U.S. Department of Agriculture.

Anthropogeography. *B. American G.S.* **41** (1909): 537–566. Jefferson.
The Anthropogeography of some Great Cities. A Study in Distribution of Population. By Mark Jefferson. Size 9½ × 6, pp. 537–566. *Plans. Also separate copy.*

Commercial—Cables. *Deutsche Rundschau G.* **32** (1909): 34–35. Webersik.
Das Kabelnetz der Erde und der überseeische Nachrichtenverkehr im Jahre 1909. Von Gottlieb Webersik. *Map.*

Commercial—Oil Palm. *Kew B.* (1909): 161–184. ——
The Economic Aspects of the Oil Palm.

Commercial—Timber. *B. Bureau American Republics* **29** (1909): 538–560. ——
The Hard Woods of the Americas—Quebracho. *Illustrations.*

Commercial Geography. Dubois and Kergomard.
Précis de géographie économique. Par Marcel Dubois et J.-G. Kergomard; avec la collaboration de Louis Lafitte. 3e édit. Paris: Masson et Cie., 1909. Size 9 × 5½, pp. xvi. and 864. *Presented by M. Marcel Dubois.*

Disease. Boyce.
Mosquito or Man? The conquest of the tropical world. London: J. Murray, 1909. Size 9 × 6, pp. xvi. and 268. *Illustrations. Price 10s. 6d. net. Presented by the Publisher.*

Economic Geography. Robinson.
Economic Geography. An Attempt to state What it is and What it is not. By Edward Van Dyke Robinson. (Reprinted from *Publications of the American Economic Association*, vol. 10, No. 1, April, 1909.) Minnesota, 1909. Size 9 × 6, pp. 12.

GENERAL.

British Empire. Jose.
The growth of the Empire: a handbook to the history of Greater Britain. By Arthur W. Jose. Revised edition. London: J. Murray, 1909. Size 8 × 5, pp. xvi. and 444. *Maps. Price 4s. 6d. Presented by the Publisher.*

Education. *J.G.* **8** (1909): 1–9. Chamberlain.
Report of the Committee on Secondary School Geography. By James F. Chamberlain.

Education. **Lyde.**

The teaching of geography. By L. W. Lyde. London. Blackie & Son, 1909. Size 6½ × 4½, pp. 120. *Price* 1*s. net. Presented by the Author.*

Oceanic Islands. **Nicoll.**

Three voyages of a naturalist; being an account of many little-known islands in three oceans visited by the *Valhalla*, R.Y.S. By M. J. Nicoll. Second edition. London: Witherby & Co., 1909. Size 9 × 6, pp. xxx. and 246. *Sketch-maps and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publishers.*

The first edition was reviewed in vol. 32, p. 81.

Place-names. *B.S. Khédiviale G.* 7 (1909): 185–195. **Galante.**

Quelques observations sur la déformation de la transcription des noms géographiques du monde musulman. Par Abraham Galante.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria. **Kober, Freytag, and Berndt.**

Schulwandkarte des Herzogtums Schlesien Bearbeitet von Rudolf Kober. Scale 1 : 100,000 or 1 inch to 1·6 stat mile. 4 sheets. Vienna: G. Freytag & Berndt, 1909. *Price, mounted on rollers*, 30*kr.*

Schulwandkarte des politischen Bezirkes Horn. Scale 1 : 40,000 or 1·6 inch to 1 stat. mile. 4 sheets Vienna: G. Freytag & Berndt, 1909. *Price, mounted on rollers*, 36*kr.*

Karte der politischen Bezirke Melk und Scheibbs. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles Karte der Bezirke Wiener-Neustadt und Neunkirchen. Scale 1 : 150,000 or 1 inch to 2·4 stat miles. Vienna: G. Freytag & Berndt, [1909]. *Price* 30 *Heller each. Presented by the Publisher.*

These are all school maps showing relief by hill-shading and contours, combined with colour tinting on what has been called the stereoscopic or prismatic principle, the tints ranging from red and reddish-brown for the highest lands to bluish-greens for the lowlands, as described in the *Geographical Journal* for June, 1907. The effect, specially in the case of the smaller scale maps, is decidedly good, and the relief is shown at a glance in a graphic manner The small map of the Melk and Scheibbs districts is certainly an excellent example of this method of showing relief. In the case of the larger scale wall maps the green is hardly satisfactory, and the change between this and the browns is too abrupt.

Austria. **Freytag and Gragger.**

G. Freytag's Schi-Routenkarte der Niederosterreichisch-Steirischen Kalkalpen. Bearbeitet von Hans Gragger. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. G. Freytag's Schi-Routenkarte des Oberen-Ennstales und der Rottenmanner Tauern. Bearbeitet von Hans Gragger. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Vienna: G. Freytag & Berndt, [1910]. *Price* 2.0*kr. each. Presented by the Publisher.*

Austria. **Rothaug.**

Karte der österreichischen Alpenlander. Bearbeitet von J. G. Rothaug. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Vienna: G. Freytag & Berndt, [1909]. *Presented by the Publisher.*

Austria-Hungary. **Hickmann.**

Prof. A. L. Hickmann's Geographisch-Statistischer Taschen-Atlas von Österreich-Ungarn. 3. Vollständig neu bearbeitete Auflage. Vienna and Leipzig: G. Freytag & Berndt, [1910]. *Presented by the Publisher.*

The third edition of a small pocket atlas, similar in form and style of production to the Universal-Taschen Atlas by the same author. Apart from the maps of Austria-Hungary, which for their scale are good and clear, a vast amount of statistical information connected with the empire is given by graphic diagrams and in tabular form.

Austria-Hungary. **Freytag.**

G. Freytag's Verkehrskarte von Österreich-Ungarn mit den Balkanländern. Scale

1 : 1,500,000 or 1 inch to 23·6 stat. miles. Vienna and Leipzig: G. Freytag & Berndt, 1910. *Price* 2.40*kr*. *Presented by the Publisher.*

Belgium. **Deventer.**

Atlas des Villes de la Belgique au XVI^e^ Siècle. Cent Plans du Geographe Jacques de Deventer exécutés sur les ordres de Charles-Quint et de Philippe II. reproduits en facsimilé chromographique par l'Institut Nacional de Géographie à Bruxelles. Publication commencée par Ch. Ruelens et continuée sous la direction de Ém. Ouverleaux et J. van den Ghenyn, S.J. 17^e^ Livraison. Brussels: M. Weissenbruch; Falk Fils, 1909.

A continuation of the atlas noticed in the *Geographical Journal* for August last. This part contains plans of Cassel, Dunkerque, Hallain-Menin, and Venloo.

Belgium. **Ministère des Chemins de Fer, Postes et Telegraphes.**

Carte Officielle des Chemins de Fer de la Belgique au 31 Décembre 1908. Scale 1 : 400,000 or 1 inch to 5·4 stat. miles. Brussels: Institut Cartographique Militaire, 1909. *Presented by the Military Cartographical Institute, Brussels.*

British Isles—Dublin. **Bartholomew.**

Plan of Dublin. Scale 1 : 19,500 or 3·2 inches to 1 stat. mile. Edinburgh: John Bartholomew & Co., 1910. *Price* 1*s. net., mounted on cloth. Presented by the Publishers.*

British Isles—England. **Feigerl.**

Contour relief models of the country north and south of London. Prepared from the Ordnance Survey by G. R. C. Feigerl. Horizontal scale 1 : 126,720 or 1 inch to 2 stat. miles; vertical scale 1 : 21,120 or 3 inches to 1 stat. mile. London: Sifton & Praed, 1909. *Price* £2 5*s. each.*

These two are the first to be published of what promises to be a most useful set of relief maps of various districts of England. They consist of sheets of the new orographically coloured Ordnance Survey maps on the scale of 2 miles to 1 inch, mounted upon carefully executed relief models, of which the vertical scale is exaggerated six times. This exaggeration is perhaps too great, and the result would have been more satisfactory if it had been only about half this amount; but bearing this difference of scale in mind, a good idea of the relief of the London basin from the Chilterns to beyond the North Downs is conveyed by the models. The orographical colouring adds considerably to their success and graphic effect, and on the whole the publishers may be congratulated on their attempt. The mounting of the maps on the models has been a most difficult matter, and it is not surprising that somewhat unsightly joins in the paper are occasionally noticeable; but with more experience improvements will doubtless be made in this respect. It is understood that other relief maps of the kind are in hand, one of which is the district to the south of the area now covered, which will include the South Downs and extend to the south coast.

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1910.

1-inch—(third edition):—

Engraved in outline, 131. *Price* 1*s.*

6-inch—County Maps:—

Cheshire, 2 sheets. **Hampshire**, 4 sheets. **Kent**, 15 sheets. **Lancashire**, 1 sheet. **Sussex**, 1 sheet. **Yorkshire**, 8 sheets. *Price* 1*s. each.*

25-inch—County Maps:—

Cheshire, 25 sheets. **Hampshire**, 19 sheets. **Lancashire**, 8 sheets. **Sussex**, 50 sheets. **Yorkshire**, 36 sheets. *Price* 3*s. each.*

(*E. Stanford, London Agent.*)

British Isles—London. **Bartholomew.**

Bartholomew's contoured map of the Environs of London. Scale 1 : 63,360 or 1 inch to 1 stat. mile. New edition. Edinburgh: John Bartholomew & Co., 1910. *Price* 2*s., mounted on cloth. Presented by the Publisher.*

British Isles—Thames Basin. **Johnston.**

The Basin of the Thames. Scale 1 : 190,080 or 1 inch to 3 stat. miles. 2 sheets. Edinburgh and London: W. & A. K. Johnston, 1910. *Price, in sheets,* 9*s. Presented by the Publisher.*

An orographically tinted school wall-map of the basin of the Thames in seven

shades of reddish-brown, increasing in density with the altitude. The names of valleys, ranges, rivers, and other physical features are given in accordance with the recent arrangement, as shown on the map published in the *Geographical Journal* for December, 1904. These are the only names, those of the principal towns being merely indicated by the initial letter, so that the map is not in the least overcrowded. Railway lines and ancient roads are shown in red, and the controlling influence of the physical features upon the direction these follow is clearly brought out. There is much to commend the map for educational purposes, although there may be room for improvement in the tints used for showing the relief. At present there is hardly sufficient difference between several of them to give an altogether satisfactory effect. An edition of the map can be obtained without names.

Europe.

Befestigungen der österreichisch-italianischen Grenze. Scale 1 : 450,000 or 1 inch to 7·1 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 20. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Europe. **Alt.**

Geographische Verteilung der Gewitter-Häufigkeit in Kontinental- und Nordeuropa. Von Dr. E. Alt. Scale 1 : 20,000,000 or 1 inch to 315·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 1. Gotha: Justus Perthes. 1910. *Presented by the Publisher.*

France. **Service Géographique de l'Armée, Paris.**

Carte de France. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets: xxvi.–11, Soissons: xxxvii. 42, Menton. Paris: Service Géographique de l'Armée, 1909. *Price* 1.60 *fr. each sheet.*

Russia. **Kawkaski.**

Die Befestigungen in Russisch-Polen. [Von F. Kawkaski.] Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 12. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

ASIA.

Armenia. **Oswald.**

Tektonische Uebersichtskarte Armeniens. Von Dr. Felix Oswald. Scale 1 : 2,340,000 or 1 inch to 36·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 2. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Based on the Dr. Oswald's geological map noticed in the *Geographical Journal* for December, 1907.

Central Asia. **Prinz.**

Uebersicht der Reisewege von Dr. Gyula Prinz in Mittelasien 1909. Scale 1 : 2,500,000 or 1 inch to 39·4 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 13. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Java. **Topographical Bureau, Batavia.**

Topographische Kaart van Java en Madoera. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: ii., iii., iv. and viii., vi., vii., x. Residentie Banjoemas; xi., xii., xiv., xv., Residentrien Banjoemas en Kedoe; xvi. Residentie Kedoe; xvii. Residentie Semarang. Batavia: Topographical Bureau, 1901–09.

These are the first published sheets of the new Government survey of Java and Madura which has been in progress for some years. According to a general map issued as an index, when complete there will be altogether about one hundred and fifty sheets, each measuring 19 inches by 15 inches. They are most creditably produced and printed in colours. Heights are shown by brown contours and figures, roads in red, vegetation and plantations green, and water blue. According to a note on the index map, the survey has been plotted on two different projections, the western half being on Bonne's, and the eastern on a form of polyhedral projection.

Sumatra. **Topographical Bureau, Batavia.**

Overzichtskaart van het eiland Sumatra. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. Batavia: Topographical Bureau, 1908.

AFRICA.

Africa. **Bartholomew.**

Central and South Africa. By J. G. Bartholomew, F.R.G.S. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. Edinburgh: John Bartholomew & Co., 1910. *Price* 3*s.*, *mounted on cloth. Presented by the Publisher.*

On the present edition of this well-known and useful general map the boundaries

and railways have been corrected to date. It is difficult to understand why hill shading is shown only on the southern part of the map, and it certainly would be an advantage if it could be completed on another edition.

British East Africa. **Geographical Section, General Staff**

British East Africa, Uasin Gishu Plateau. Scale 1: 62,500 or 1·014 inch to 1 stat. mile. Sheets 3, 4, and 5. London: Geographical Section, General Staff, War Office, 1909. *Price* 1*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

Egypt. **Survey Department, Cairo.**

Topographical map of Egypt. Scale 1: 50,000 or 1·3 inch to 1 stat. mile. Sheets: N.W. V.–I., Kafr el Zayat; VI.–I., Kafr el Sheikh; VII.–I., Shalma; VIII.–I., Lake Borollos east; VIII.–II., Lake Borollos west; VIII.–III., Rosetta; S.E. XXVIII.–IX., Kom Ombo east; XXXI.–VIII., Dabod; XXXII.–VIII., Dehmit; XXXIII.–VIII., Kalabsha. Cairo: Survey Department, 1909. *Presented by the Director-General, Survey Department, Cairo.*

German South-West Africa. **Quelle.**

Diamant-Fundstellen in Deutsch-Südwestafrika nach dem gegenwärtigen Stande der Kenntnis. [Von Dr. O. Quelle.] Scale 1:1,500,000 or 1 inch to 23·6 stat. miles. Diamant-Bergbaufelder bei Lüderitzbucht und Pomona. Scale 1: 500,000 or 1 inch to 7·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 5. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Ivory Coast. **Meunier.**

Carte de la Côte d'Ivoire. Dressée par A. Meunier. Scale 1: 500,000 or 1 inch to 7·8 stat. miles. Sheets: 3, Séquéla; 4, Kouadiokofi; 5, Sassandra; 6, Bingerville. Paris: Ministère des Colonies, Service Géographique et des Missions, 1905.

Northern Nigeria. **Geographical Section, General Staff.**

Northern Nigeria. Scale 1: 2,000,000 or 1 inch to 31·5 stat. miles. London: Geographical Section, General Staff, War Office, 1909. *Price* 3*s. Presented by the Director of Military Operations.*

This map can be obtained in two styles, with and without orographical tinting.

Sahara-Sudan. **Marquardsen.**

Das Saharisch-Sudanische abflusslose Gebiet von H. Marquardsen. Scale 1: 6,000,000 or 1 inch to 94·7 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 4. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

This map extends in latitude from 4° to 6° N., and in longitude from 6° to 24° E. It thus includes the Lake Chad and Shari basin, together with the Tibesti mountains, Fezzan, Wadai, and the greater part of Northern Nigeria. Relief is indicated by orographical tinting in eleven shades of colour; but considering how little is known of many parts of this vast region, this is a bold attempt, and can only serve to give a very approximate idea of relative altitude. The map accompanies the paper by Dr. H. Marquardsen in the January number of *Petermanns Geograph. Mitteilungen* for the present year.

Sudan **Kumm.**

Uebersicht von Dr. K. Kumms Durchquerung von Afrika durch den Sudan. Scale 1: 7,500,000 or 1 inch to 118·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 17. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1: 100,000 or 1 inch to 1·6 stat. mile. Sheet cviii. Foum Tataouine. Paris: Service Géographique de l'Armée, [1909]. *Price* 1.20 *fr. each sheet.*

AMERICA.

Canada—Saskatchewan. **Dept. of Public Works, Saskatchewan.**

Map of the southern part of the Province of Saskatchewan. Scale 1: 633,600 or 1 inch to 10 stat. miles. Corrected to October 1, 1909. 2 sheets. Regina: Department of Public Works, 1909. *Presented by the Commissioner of Public Works, Regina, Saskatchewan.*

Patagonia. **Krüger.**

Das Andine Gebiet Patagoniens zwischen 40° und 44° S. Nach den Arbeiten der chilenischen und argentinischen Grenzkommissionen und eigenen Aufnahmen entworfen und gezeichnet von Prof. Dr. Paul Krüger. Scale 1: 500,000 or 1 inch

to 7·8 stat. miles. *Petermanns Mitteilungen*, Ergaenzungsheft 164. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Peru and Bolivia.

Endgiltige Linienführung der neuen Grenze zwischen Peru und Bolivien. Scale 1: 2,000,000 or 1 inch to 31·5 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 18. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Peru and Ecuador. **Sievers.**

Uebersicht von Wilhelm Sievers' Reisen in Peru und Ecuador 1909. Scale 1: 7,500,000 or 1 inch to 118·4 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 6. Gotha: Justus Perthes, 1910 *Presented by the Publisher.*

AUSTRALASIA

Australasia. **Robinson.**

"The Lady Northcote" Atlas of Australasia. By H. E. C. Robinson. With an historical introduction on the discovery and exploration of Australia by Charles R. Long, M.A. Geological notes by Leo. A. Cotton, B.A., B.SC., and an alphabetical index to places on the maps. Sydney: H. E. C. Robinson, 1908.

An atlas of eighteen plates of maps and plans, specially prepared for use in Australian schools and colleges and commercial establishments, under the auspices and support of Lady Northcote. In addition to the general maps of the continent and special maps of its various states, Tasmania, and New Zealand, there are maps of the world showing British possessions and spheres of influence, the principal Australian trade routes, meteorological, orographical, and geological maps, and ten historical diagrams, showing the division of Australia from 1787 to 1908. An interesting feature is the short and concise chapter on the discovery and exploration of Australia by C. R. Long, M.A. As specimens of cartography the maps are poor productions, but as a whole the atlas contains a considerable amount of useful information brought together by Australians from an Australian standpoint.

New Guinea. **Hemel and Reiber.**

Das Torricelli-Gebirge (Kaiser Wilhelm-Land) und das ihm vorgelagerte Hügelland. Terrainaufnahmen von P. Const. v d. Hemel, Geolog. Aufnahmen von P. Josef Reiber, 1907. Scale 1: 200,000 or 1 inch to 3·2 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 16. Gotha. Justus Perthes, 1910. *Presented by the Publisher*

New South Wales. **Robinson.**

Map of New South Wales showing Shires and Municipalities. By H. E. C. Robinson. 2 sheets. Scale 1: 1,013,760 or 1 inch to 16 stat. miles. Sydney: H. E. C. Robinson, [1909].

A bold but somewhat roughly executed map, in two sheets, measuring 38 × 54 inches, showing shires and municipalities in red. A small inset map of New South Wales is given in the south-east corner, through which a vertical section along each degree parallel of latitude is drawn. The purpose of these sections is doubtless to give an idea of the general relief of the country, but for this purpose an orographically tinted map would perhaps have served better.

GENERAL.

World. **Hickmann.**

Prof. A. L. Hickmann's Geographisch-Statistischen Universal-Taschon-Atlas. Vienna and Leipzig: G. Freytag & Berndt, 1910. *Presented by the Publisher.*

This is practically a reprint of the edition published last year.

World. **Johnston.**

The World-Wide Atlas of Modern Geography. Political and Physical, containing one hundred and twenty-eight plates and complete index, with an Introduction by J. Scott Keltie, LL.D., etc. Seventh edition (revised). Edinburgh and London: W. & A. K. Johnston, Ltd., 1910. *Price 7s. 6d. Presented by the Publisher.*

A new edition of this well-known atlas. Although useful for general reference and handy in size, the maps are somewhat rough productions, and many of them not over-clear.

World. **Kiepert.**

Henerici Kiepert. Formae Orbis Antiqui. 36 Karten mit kritischem Text und Quellenangabe zu jeder Karte. No. viii. Asia Minor imperatoris Traiani tempore.

Mit 20 Seiten Text. Bearbeitet und herausgegeben von Richard Kiepert. Berlin: Dietrich Reimer (Ernst Vohsen), 1910. *Price* 3m. *each sheet.*

An important sheet of this valuable atlas, showing Asia Minor at the time of the Emperor Trajan. The map has been prepared from the best available sources, and indicates clearly the leading physical features, as well as the political divisions, cities, and towns, roads, and other interesting information connected with the period dealt with. It is accompanied by twenty pages of text giving a very complete geographical account of the region and its then existing provinces, together with a full list of the authorities consulted.

World. **Rothaug.**

Geographischer Volksschul-Atlas für vier-bis sechsklassige Volksschulen-Ausgabe für Nieder-Österreich mit Ergänzung für Wien. Bearbeitet von Joh. Georg Rothaug. Vienna: G. Freytag & Berndt, 1909. *Price* 1.50 *kr.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during December, 1909. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 3739, Scotland, west coast: Upper part of Loch Long and Loch Goil, 2*s.* 975, United States, Gulf of Mexico: Approaches to Sabine pass, 3*s.* 3752, Red Sea Gulf of Suez: Gimsah and Kabreit anchorages and approaches, 2*s.* 3730, Plans on the south coast of Ceylon: Weligama bay, Hambantota, 2*s.* **New Plans and Plans added**—No. 3618, Vancouver island. Moresby passage to Gabriola pass: Plan added: Boat harbour, 3*s.* 1962, China, south coast. Hong Kong to the Brothers: New Plan: Tai Sami, 4*s.* 2659, Solomon islands. Plan added: Mboli harbour, 1*s.* 6*d.* 1730, Samoa or Navigator islands. Plans added: Asaua harbour, Satupaitea road, Vatia anchorage, 3*s.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, January, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, March, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, February, 1910. London: Meteorological Office, 1910. *Price* 6*d. each. Presented by the Meteorological Office.*

Atlantic, South. **U.S. Weather Bureau.**

Meteorological chart of the South Atlantic Ocean, Season—March, April, May, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S. Weather Bureau.*

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, February, 1910. London: Meteorological Office, 1910. *Price* 6*d. each. Presented by the Meteorological Office.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, February, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, March, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S. Weather Bureau.*

Pacific, South. **U.S. Weather Bureau.**

Meteorological chart of the South Pacific Ocean, Season—March, April, May, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the Weather Bureau.*

PHOTOGRAPHS.

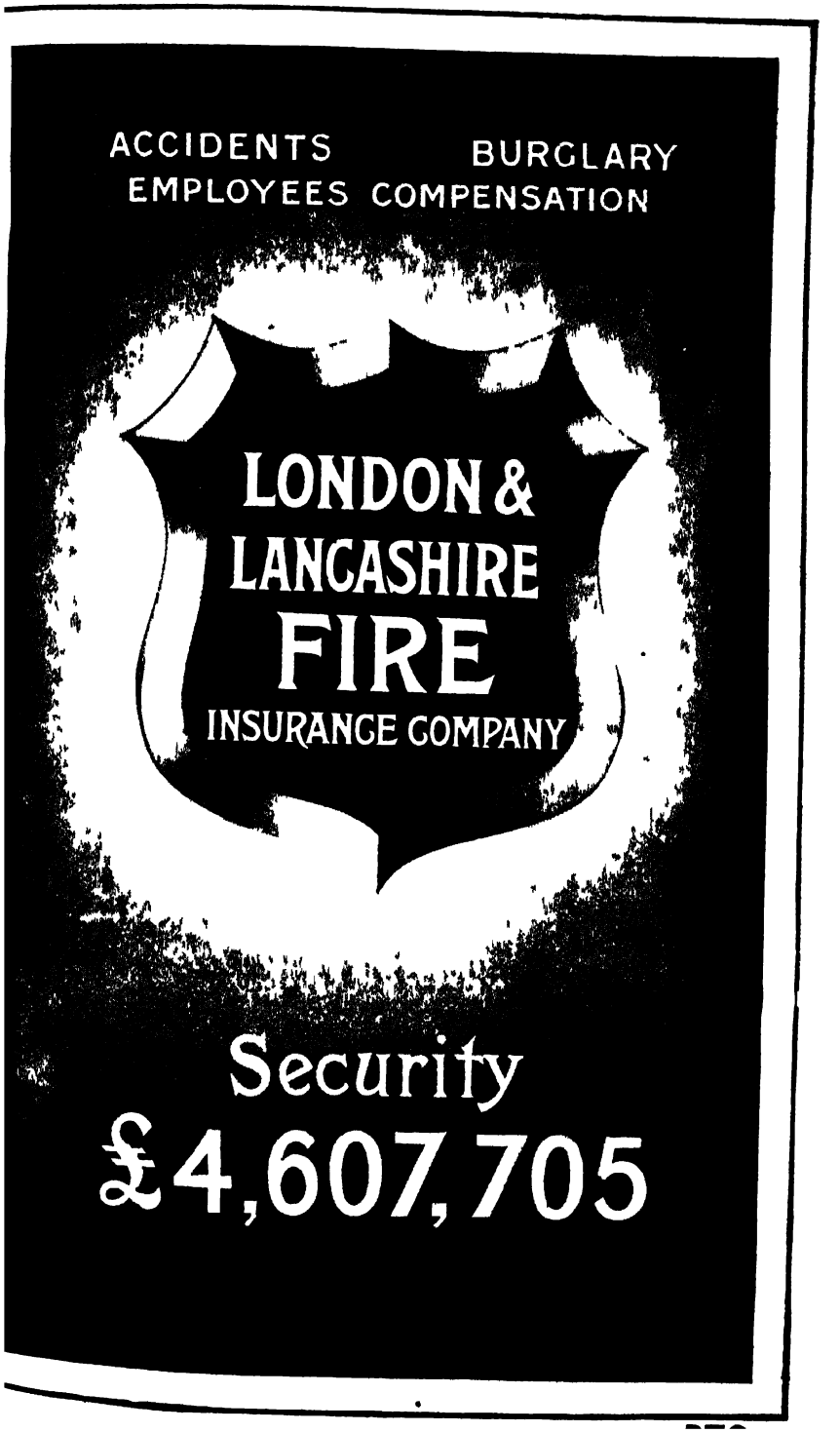
Kashmir. Workman.

Ninety-two reproductions from photographs taken on the Bullock-Workman Expedition of 1906 to the Nun Kun, Kashmir. *Presented by Dr. W. H. Workman and Mrs. Fanny Bullock Workman.*

The expedition during which these photographs were taken was described in the *Geographical Journal* for January, 1908. They are reproductions of photographs which appear in Dr. Workman's book on the journey, bound in a separate album.

(1) On a projecting rock buttress of Pinnacle peak, at altitude of 23,000 feet; (2 and 3) Camp at Sonemarg; (4) At the porter's camp-fire; (5) On the march, Sind valley; (6) Women-samindars, Ladakh; (7) First view of Nun Kun from the Suru valley; (8) Washing day in camp at Suru; (9) Highest Nun Kun peak; (10) Mate and Suru coolies at base camp on Shafat glacier; (11) Lama lambardar and women of Tasi Tonzas; (12) Fording Suru river; (13) Shafat nala and lower 3 miles of Shafat glacier; (14) Large moraine-covered hillock forced up by pressure at the junction of West branch with Shafat glacier; (15) Pinnacle peak, 23,300 feet; (16) Part of base camp, 15,100 feet, Shafat glacier; (17) Interior of tent at base camp, Shafat glacier; (18) Z1 from Shafat glacier; (19) Ice-fall branch of Shafat glacier and peaks at its head; (20) Panorama east from summit of D41; (21) Ice-fall on Ice-fall branch of Shafat glacier; (22) Climbing a sérac on Ice-fall glacier; (23) Nieve penitente, wind-conditioned variety, on Shafat glacier; (24) Highest Nun Kun peak, and White Needle peak; (25) Camp Nieve Penitente, 17,657 feet; (26) First view of White Needle camp, 19,900 feet; (27) Telephotograph of the White Needle; (28) White Needle camp, looking east; (29) White Needle camp at base of ice-wall; (30) Camp Italia, 20,632 feet, on Nun Kun plateau; (31) Camp Italia, looking south-west; (32) A slant which would have to be climbed in ascending highest Nun Kun peak from plateau; (33) Highest Nun Kun peak; (34) Ascending a sharp snow-slant; (35) Camp America, 21,300 feet, at head of Nun Kun plateau; (36) At the base of a broken ice-wall; (37) A projection on Pinnacle peak, showing gradients; (38) Peak Mer, 23,264 feet; (39) Panorama east from summit of Mount Nieve Penitente; (40) View from summit of Pinnacle peak; (41) Pinnacle peak, southern face; (42) Breakfast at camp Italia; (43) Upper 3 miles of Shafat glacier; (44) A nieve penitente pinnacle; (45) Nun, or Ser, 23,449 feet; (46) Termination of Ganri glacier in ice-precipice at Suru river; (47) High lateral moraine of Ganri glacier; (48) Crevassed and broken upper part of Fariabad glacier; (49) North-west nala, as seen from spur of Z1; (50) Stone cairn marking site of base camp; (51) View of Zaskar peaks; (52) Tongue of Fariabad glacier; (53) Tongue of Z1 glacier. (54) View east down North-West nala from glacier at its head; (55) On North-West col, 17,397 feet; (56) Barmal La; (57) Barmal camp on Barmal La; (58) Panorama of reservoir of Shafat glacier; (59) Barmal glacier; (60) Mount Nieve Penitente from Sentik La. (61) Part of dangerous ice-wall that has to be climbed on ascent of Mount Nieve Penitente; (62) On summit of Mount Nieve Penitente, 19,080 feet; (63) Bird's-eye view of North-West nala; (64) D41, 20,571 feet; (65) On summit of sharp rock-apex of D41. (66) View west down Barmal glacier; (67) View south from shoulder of Peak No. 10 on Bhot Kol glacier; (68) Final descent from the Barmal La to the Barmal glacier; (69) The Sentik La from Sentik glacier; (70) Telephotograph of D41; (71) Sunlight and shadow at noonday; (72) Patches of *névé*; (73) *Névé* ridges; (74) Flat-topped nieve pinnacle; (75) Avalanche bed on Hispar glacier; (76) Panorama of south-western half of Nun Nun plateau; (77) Nieve penitente on bed of snow avalanche; (78) Serrated avalanche penitente; (79) View at sources of Hispar glacier at 17,000 feet; (80) Nieve penitente, subsidence variety; (81) Wind-conditioned nieve penitente; (82) Thin *débris*; (83) Glacier table on lower portion of Biafo glacier; (84) Glacier-table penitente pyramid; (85) Glacier table; (86) Glacier-table nieve pyramids; (87 and 88) Thick detritus, mud-covered nieve penitente; (89) Mud-covered nieve pyramid; (90) Sand-covered penitente pyramid; (91) Lacustrine or composite nieve penitente; (92) Sérac penitentes, both large and small.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


ACCIDENTS
BURGLARY
EMPLOYEES COMPENSATION
LONDON &
LANCASHIRE
FIRE
INSURANCE COMPANY
Security
£4,607,705



Fire :

Simple Contracts Latest Concessions

Consequential Loss :

Reimbursement of
Profits - Standing Charges -
Increased Cost of Working

Accident :

Increased Benefits Optional Schemes.

Burglary. Plate Glass
Fidelity Guarantee Third Party
Boiler and Electrical Plant.
Employees' Compensation.

Marine :

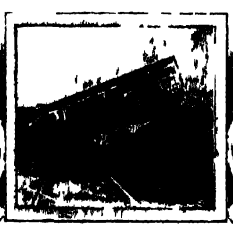
Registered Post Passengers' Baggage
Specie Insurance Transit Risk

Send for latest terms etc to

London & Lancashire Fire Insurance Co.,

45 Dale Street Liverpool
76, King William Street E C

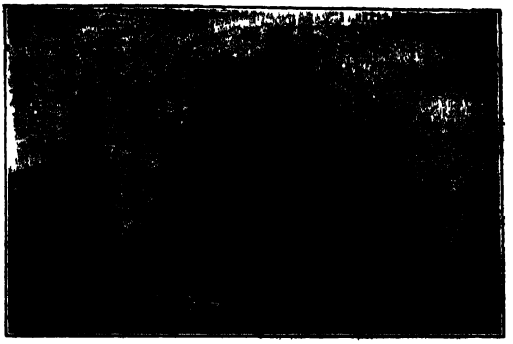
or any of its 40 Branches.



HOTEL METROPOLE,

Northumberland Avenue, Trafalgar Square,

LONDON.



Of world-wide reputation. Conveniently situated, close to Houses of Parliament, Westminster Abbey, Government Offices, Theatres, fashionable quarters, and chief places of interest. Numerous luxuriously furnished suites of apartments. Most magnificent hotel boulage in London.

Telegrams: "*Metropole, London.*"
Telephone: 8180 *Gerrard* (20 *lines*).

Gordon Hotels, Ltd.

AROSA.

GRISONS, SWITZERLAND.

6000 feet above Sea-level. Splendid Winter Resort. Recommended by the greatest Medical Authorities.

HOTEL SEEHOF. FIRST-CLASS HOTEL.

Finest situation in Arosa on the Lake. Specially adapted for English visitors during the winter season Electric light and central heating throughout. New drawing-room and billiard-room with English and French billiards.

CURLING RINK IN FRONT OF THE HOTEL. SKI-ING, SKATING, AND TOBOGGANING.

PENSION, PRICE, 8-14 FRS

For Prospectus and all particulars apply to the proprietor—

Telegraphic Address:—"SEEHOF, AROSA" P. WIELAND.

BÂLE. "HOTEL, VICTORIA."

(*Quite near Central Railway Station.*)

First-class Family House of old reputation. Lately quite renewed. Fine Large Hall, New Salon, and Conversation Rooms. Restaurant. Electric light and central heating in whole house.

NEW BATHS. LIFT. GOOD CUISINE. MODERATE CHARGES.

Managed by the Proprietor—PAUL OTTO.

BROWN & ROWLEY

WATLING STREET, CITY,

Printers,

Account Book

Manufacturers,

AND

General Stationers.

Contractors to the Royal Geographical Society.

THE WROUGHT IRON

CAMP OR TRAVELLING STOVE



To burn wood or any fuel.

Specially designed for Explorers, Missionaries, etc.

Made of malleable wrought iron. Cannot be injured by rough usage. Weight 36 lbs.

Price complete, £3.

Specialities in Oil Cooking Stoves for Home and Export. Any kind of stove made to order.

Send for a 100-page Illustrated Catalogue of Stoves for all purposes, which will be sent free by mail on application.

W. FOORD & CO., American Stove Stores, 58, Queen Victoria Street, London, E.C.

YOU CAN INSURE YOUR

Treasures, Family Heirlooms, &c.

AGAINST FIRE, BUT

Can You Replace Them?

THOUGH

Dreadnought" Fireproof Doors

cost no more than Wood Doors and are of ordinary appearance, thickness, and weight, they have been able to withstand a temperature of 2000 degrees for 2½ hours. No hinged door of such a size has withstood

ALF AS GREAT AN OFFICIAL FIRE TEST AS THIS.

Supplied to the Government for

s Admiralty, National Gallery, Victoria and Albert Museums, Imperial College of Science, Imperial Institute. Also Birmingham Telegraph Office; to Edinburgh Law Courts, Royal Insurance Company, Cox's Bank, &c., &c.; to Lord Lilford, and many private mansions.

Write for full particulars to

"G.J." DEPT., FIREPROOF DOORS, Ltd.,
46, KING WILLIAM STREET, LONDON, E.C.

"RONUK" (SANITARY)

For effect on Floors, See the National Gallery, Tate Gallery, etc.

POLISH.

Polishes, Preserves, and Purifies Furniture, Floors, Linoleum, etc.



Special Kinds for Glacé and Brown Boots, and Brown and Black Harness, etc.

Highly Concentrated. **Use Little and Rub Lightly.**

In Tins, 3d., 6d., 1s., and 2s., Everywhere.

"RONUK," LTD., Portslade, near Brighton.

London Depôt: 88, YORK ROAD, LAMBETH, S.E. Manchester Depôt: 295, DEANSGATE.

For List of Council and Officers, Conditions of Admission to the [illegible] and Society, Medals, see pages ii., iv., v., and viii.

The Geographical Journal.

Authors are alone responsible for their respective statements. In MS. communications all new or unfamiliar geographical names should be written in imitation of Roman type. All communications for the Editor should be addressed to 1, Savile Row, London, W.

CONTENTS—APRIL.

PAGE

Journeys in Kurdistan. By Captain Bertram Dickson (with 6 Plates and Map) . . . 357
The Sand-Dunes of the Libyan Desert. By H. J. Llewellyn Beadnell, F.C.S., F.R.G.S., Assoc. Inst. M.M., formerly of the Geological Survey of Egypt (with 4 Plates, Sketch-map, and Diagrams) 379
Problems in Exploration—Central Asia. By Ellsworth Huntington 395
The Present Trend of Geography in the United States. By R. H. Whitbeck, University of Wisconsin, Madison 419
Egyptian Irrigation. By Colonel Sir Colin C. Scott Moncrieff, K.C.M.G., K.C.S.I. . . 425
New Light on Verrazzano's Voyage of 1524 428
A Contribution to Geographical Bibliography. By F. S. A. 430
Reviews :—
EUROPE—The North Sea. Crete. ASIA—The Western Himalaya. AFRICA—Abyssinia. Uganda and the Sudan. The Heart of Central Africa. AMERICA—Chile. Chilean Surveys. POLAR REGIONS—Antarctic Meteorology. MATHEMATICAL AND PHYSICAL GEOGRAPHY—The North Atlantic GENERAL—Text Book. Sir Charles Wilson 433
The Monthly Record 445

EUROPE
History of the Mapping of the British Isles
The Avon and Don at Inchrory, Banffshire
The Warnow Region in Mecklenburg
The Climate of Austria
The Origin of the Bosporus and the Dardanelles
ASIA
Japanese Expedition to Chinese Turkestan and Mongolia
A Memento of the Portuguese Occupation of Ormuz
Mining Industry in Kansu. Exploration on Tibetan Frontier
AFRICA
Evaporation in Egypt and the Sudan
Overweg's Grave

AFRICA—*continued.*
A Population Study of French Guinea
Dr. Pöch's Travels in the Southern Kalahari
Minerals of Nyasaland
AMERICA
Marsh and Pond Vegetation on the Northern Coast of New Jersey
Captain Whiffen's Journey in the Amazon Basin
AUSTRALASIA AND PACIFIC ISLANDS
The British Expedition to Western New Guinea
The Gilbert and Ellice Islands
POLAR REGIONS
A German Antarctic Expedition

Obituary—Colonel Claude Reignier Conder, R.E., LL.D. 456
Correspondence.—The Altitude of Mount Huascaran. By Fanny Bullock Workman. Mesopotamian Trade—Noah's Flood—The Garden of Eden. By Sir William Willcocks, K.C.M.G., and H. Rassam 458
Meetings of the Royal Geographical Society, Session 1909–1910 460
Geographical Literature of the Month 461
New Maps 475

MAPS.

Sketch-map of Approximate Distribution of Sand-Dunes of the Libyan Desert . . 381
Sketch-map of Part of Kurdistan 430

SOLD BY

PARIS: Parker.
VIENNA: Artaria & Co.
AMSTERDAM: L. Friedericksen & Co.
ST. PETERSBURG: Watkins & Co.

MANCHESTER: John Heywood.
EDINBURGH: Douglas & Foulis.
DUBLIN: Hodges, Foster & Co.

BERLIN: D. Reimer.
LEIPZIG: F. A. Brockhaus.
NEW YORK: International News Co.

ROYAL GEOGRAPHICAL SOCIETY.

PATRON.

HIS MAJESTY THE KING.

VICE-PATRON.

HIS ROYAL HIGHNESS THE PRINCE OF WALES, K.G.

COUNCIL.

(ELECTED MAY 24, 1909.)

President—Major LEONARD DARWIN.

Vice-Presidents.

Admiral Sir LEWIS BEAUMONT, K.C.B., K.C.M.G.
Rt. Hon. Lord CURZON OF KEDLESTON, G.C.S.I., G.C.I.E., etc.
DOUGLAS W. FRESHFIELD.
Rt. Hon. Sir J. WEST RIDGEWAY, K.C.B., G.C.M.G., K.C.S.I.
H. YATES THOMPSON, J.P.
Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., F.S.A.

Treasurer—EDWARD L. SOMERS COCKS.

Trustees—Right Hon. Lord AVEBURY, D.C.L., F.R.S.; Lord BELHAVEN AND STENTON.

Honorary Secretaries—Colonel CHAS. F. CLOSE, C.M.G., R.E.; Colonel Sir D. A. JOHNSTON, K.C.M.G., C.B., R.E.

Foreign Secretary—Sir JOHN KIRK, K.C.B., G.C.M.G., F.R.S.

Members of Council.

HENRY BALFOUR, M.A., F.Z.S.
Captain H. H. P. DEASY.
Admiral A. MOSTYN FIELD, F.R.S.
Colonel H. W. FEILDEN, C.B.
Sir WILLIAM EDMUND GARSTIN, G.C.M.G.
Sir DAVID GILL, K.C.B., LL.D., F.R.S.
Rt. Hon. Sir GEORGE D. TAUBMAN GOLDIE, K.C.M.G., F.R.S., D.C.L., LL.D.
Colonel R. C. HELLARD, C.B., R.E.
Sir CLEMENT L. HILL, K.C.M.G., K.C.B., M.P.
Colonel Sir THOMAS HUNGERFORD HOLDICH, K.C.M.G., K.C.I.E., C.B., R.E.
JAMES F. HUGHES.
Rt. Hon. Lord LAMINGTON, G.C.M.G.
Sir GEORGE S. MACKENZIE, K.C.M.G., C.B.
HALFORD JOHN MACKINDER, M.A.
ALFRED P. MAUDSLAY.
Colonel F. R. MAUNSELL, C.M.G., R.A.
Earl of RONALDSHAY, M.P.
Captain R. F. SCOTT, C.V.O., R.N.
Colonel Sir COLIN C. SCOTT-MONCRIEFF, K.C.M.G., K.C.S.I., R.E.
Dr. AUBREY STRAHAN, F.R.S.
Sir EDWARD P. TENNANT, Bart., M.P.

Secretary and Editor of Publications—J. SCOTT KELTIE, LL.D.
Librarian—EDWARD HEAWOOD, M.A.

Map Curator.
EDWARD A. REEVES, F.R.A.S.

Chief Clerk.
S. J. EVIS.

Bankers—Messrs. COCKS, BIDDULPH and Co., 43, Charing Cross.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and £3 as annual "subscription for the current year, and thereafter a yearly subscription of £3, due on the 1st January "of each year; or he may compound either at entrance by one payment of £45, or at any subsequent "period on the following scale, provided that there shall be at the time no arrears due by him to "the Society:—

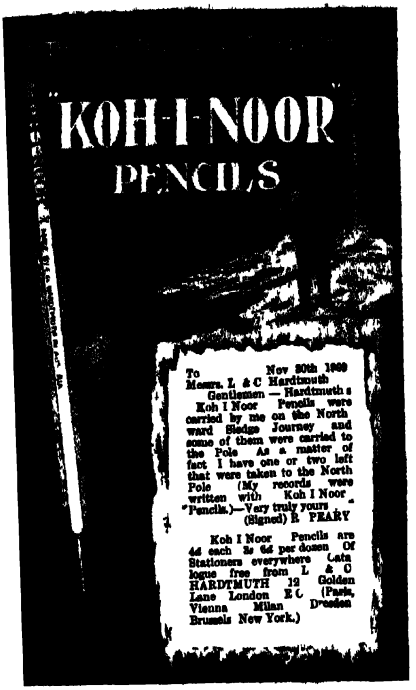
Fellows of 10 years' standing and under	15		...	£30
"	15	"	"	20	...	£24
"	20	"	"	and over	...	£18 15s.

"No fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear."

All Subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Library and Map-room. Each Fellow is also entitled to receive a copy of all the Society's Periodical Publications.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had on application at the Society's Office, 1, Savile Row, London, W.



MONTHLY 1/- NET.

TRAVEL AND EXPLORATION.

(Edited by EUSTACE REYNOLDS-BALL.)

APRIL, 1910.

Sarawak: The White Raja's Kingdom. HARRY DE WINDT, F.R.G.S.

Two Ladies in Tibet.

The Sportsman's Battery. F. C. SELOUS.

Riviera Polo. Captain E D. MILLER, D.S.O.

Khartoum: A Renascent Capital. W. E. GARR, F.R.G.S.

Travel Photography. II.

No Man's Land (Labrador). "SEARCHLIGHT"

Outfit and Equipment for the Traveller, Explorer, and Sportsman. IV

AN APPRECIATION.

The Contemporary Review, February, 1910

"We must notice the publication of the second Volume of **Travel and Exploration**, a monthly illustrated magazine edited by Mr Eustace Reynolds-Ball, since both letterpress and illustrations are of real value We are taken to every part of the world, and see Nature and life depicted by the pen and camera of experienced travellers. From an East African farm we pass to a Mexican mining camp, from a Wessex caravan to a North Canadian waggon, from French Indo-China to the Bernese Oberland, from Central Africa to Central Asia, from the Andes to Kashmir and the Taklamakan Desert, from Lapland to the Holy Land, from Java to Scawfell, from Syria to the South Pole"

WITHERBY & Co, 326, HIGH HOLBORN, W.C.

CARY PORTER, LTD. **Traveller's Surveying Instruments.**

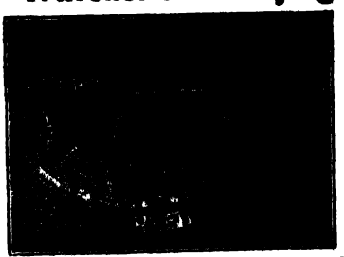
7, PALL MALL, LONDON, S.W.

Established 1765.

BY SPECIAL APPOINTMENT TO THE

Admiralty, War Office, India Office, Ordnance Survey, Crown Agents for the Colonies, Royal Naval and Military Colleges, and other Government Departments. German, Russian, Japanese, and other Foreign Governments.

FACTORY—FINSBURY PARK, N.



Theodolites, Sextants, Artificial Horizons, Telescopes, Barometers, Plane Tables, Binoculars, Compasses, etc.

Only maker of Reeves' Patent Endless Tangents and Artificial Horizons.

GRAND PRIZE AND GOLD MEDAL—FRANCO-BRITISH EXHIBITION, 1908.



DOULTON'S

1909 Patent

TRAVELLER'S PUMP FILTER

ASSURES

Pure Drinking Water

Vide *British Medical Journal* and *Journal of Hygiene.*

OBTAINABLE THROUGH ALL STORES AND OUTFITTING HOUSES.

ROYAL DOULTON POTTERIES,

Lambeth, London, S.E.

DELICIOUS COFFEE.

RED WHITE & BLUE

For Breakfast & after Dinner.

NOTICES.*

Ordinary Meetings during April and May.—**Monday, April 11.** Across Africa from the Niger to the Nile. By Dr. Karl Kumm.—**Monday, April 18.** Exploring and Climbing in the Karakoram. By Dr. T. G. Longstaff.—**Monday, April 25.** The Aldabra and Neighbouring Islands in the South-Western Indian Ocean. By J. C. F. Fryer.—**Wednesday, May 4 (Special Meeting).** To the North Pole and Back. By Rear-Admiral R. E. Peary.—**Monday, May 9.** The Land of the Incas. By Sir Clements R. Markham, K.C.B.—**Monday, May 23.** Anniversary Meeting.

Research Department, Thursday, April 21.—Further Experiments on Dew Ponds. By Edward A. Martin.

Anniversary Dinner.—The Anniversary Dinner will be held in the Whitehall Rooms in the evening of May 23, at 7.30 p.m. Fellows wishing to attend should apply for tickets, price one guinea, to the Chief Clerk, 1 Savile Row, W. Fellows may bring guests.

Year-book for 1909.—The Year-book for 1909 is now ready, and can be obtained on application to the Chief Clerk, 1 Savile Row, W. Price, to Fellows, 1*s.*; to non-Fellows, 2*s.* 6*d.*

Fellows' Reading-room.—The front room on the first floor of the Society's house is arranged as a Reading-room for Fellows. On a few days of the year it will be required for Meetings of the Council, on which occasions a notice will be fixed outside the door of the room.

Any Fellow desiring to have notice of the subjects of papers to be read at the Society's Meetings forwarded to him, can receive such notices by post on payment in advance to the Chief Clerk, at 1, Savile Row, of 2*s.* per session.

Election of Council.—In accordance with the resolution of the Council of November 10, 1891, it is herewith notified that "any names of persons qualified to fill the vacancies occurring on the Council, with their qualifications, suggested in writing to the secretaries before the first of May by Fellows, will be considered by the Council in drawing up the Balloting List" for the next Annual Meeting.

* See also pp. vi., viii., and x.

WRIGHT'S
COAL TAR SOAP

is acknowledged as an

ABSOLUTE SPECIFIC

in warding off the bites of

Mosquitos and Other Insects.

"VERB. SAP. ON GOING TO WEST AFRICA," says: "Wright's Coal Tar Soap is good for Prickly Heat and refreshing to the skin."

For Travellers it is packed in an Enamelled Tin Box, containing one Tablet, price 5d.

If any difficulty in obtaining, please write to
The Proprietors of WRIGHT'S COAL TAR SOAP,
48, Southwark Street, London, S.E.



"BERKEFELD" FILTER



YIELDS

Absolutely Pure and Germ Free Water.

IN USE ALL OVER THE WORLD.

General Sir James Willcocks, D.S.O., in the *Empire Review*, says:—

"One word more regarding Camp Equipment and I have done. Whatever may or may not be taken, it is absolutely necessary to have a couple of portable filters, and the 'Berkefeld' is the best."

THE BERKEFELD FILTER CO., LTD.,

121, OXFORD STREET, LONDON, W.

Experience has taught that no expedition may be considered to be completely and thoroughly equipped without a plentiful supply of

BOVRIL

KEEPS GOOD FOR ANY LENGTH OF TIME.

Telegraphic Address—"ZEITGEIST, LONDON." Telephone—4284 GERRARD.

EDWARD STANFORD,

Geographer to His Majesty the King.

Government Map Depôt: 12, 13, and 14, LONG ACRE, LONDON, W.C.

DEPARTMENTS.

PUBLISHING.—Maps and books arranged for and published. Estimates and terms on application.

MAP SELLING.—This department includes the productions of every map publisher of repute both at home and abroad, including the ORDNANCE and GEOLOGICAL Survey Maps, and the ADMIRALTY CHARTS, with the Pilots and Sailing Instructions which accompany them.

MAP MOUNTING OF ALL KINDS done on the premises by skilled workmen.

MAP ENGRAVING.—This department includes Drawing, Lithography, and Engraving of all kinds. Edward Stanford's large collection of copyright Maps is available for transfers for book illustration, etc. Estimates given.

BOOK SELLING.—The best Guide Books, Works of Travel, and all standard Geographical Works are kept in stock. Books of any sort supplied.



PORTABLE

ACETYLENE LIGHTS.

Easy to carry. Easy to handle. Easy to understand.

No attention required after lighting.

FOR TRAVELLERS. PROSPECTORS. PIONEERS.

For all Countries and all Climates.

FLARE-LIGHTS each 500 to 5000 c.p. **HAND-FLARES** 250 to 1000 c.p.

Not affected by Weather. Will stand a Gale.

HAND-LAMPS 100 c.p. **HAND-LANTERNS** 20 c.p.

PORTABLE GENERATORS complete in one casing for 2 to 20 lights.

Full particulars from the Patentees and Sole Makers—

C. C. WAKEFIELD & CO., 27, CANNON STREET, LONDON, E.C.

NOTICE.

PHOTOGRAPHS.

ROYAL GEOGRAPHICAL SOCIETY.

It would greatly add to the value of the Collection of Photographs which has been established in the Map Room of the Royal Geographical Society, if all the Fellows who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they would be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

POTTER'S

Catalogue (84 pp.) of

Books on Travel and Sport

(chiefly new copies at greatly reduced prices)

SENT POST-FREE.

WILLIAM POTTER,

30, Exchange Street East, Liverpool.

BOUGHT. SOLD.

CAMERAS

EXCHANGED

ILLUSTRATED BARGAIN LISTS POST FREE

1,300 BARGAINS.

May we send particulars?

THE **WESTMINSTER**

PHOTOGRAPHIC EXCHANGE, LTD

111, OXFORD STREET, 115, VICTORIA STREET, *LONDON.*

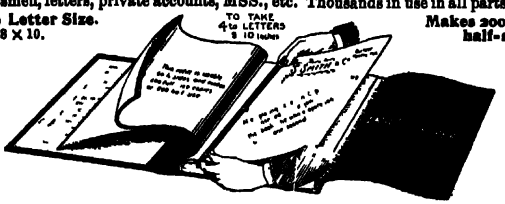
The Zanetic Pat. Copying Book

To copy letters while writing, you simply place your writing paper in the Zanetic copying book and write as usual. The Act of Writing produces the copy. Extremely useful for keeping copies of orders to tradesmen, letters, private accounts, MSS., etc. Thousands in use in all parts of the world.

Order as No. 20/100 Letter Size.
To take letters 8 × 10.

4/9 complete.
Weight 1lb. 14oz.
Refills 1/6 each.
Weight 12oz.

The simplest, yet the most efficient and economical of all copying systems.



Makes 200 full size or 400 half-size copies.

If 200 leaves 5/6, refills 2/3 each. Note size 100 leaves 3/6 refills 1/3 each, or if 200 leaves 3/9, refills 1/6 each

Samples of Zanetic copying paper free from—

THE PENCARBON CO., Ltd., Wellington Street, LEICESTER.

BROWN & ROWLEY

WATLING STREET, CITY,

Printers,
Account Book
Manufacturers,
AND
General Stationers.

Contractors to the Royal Geographical Society.

NATURAL HISTORY

WATKINS & DONCASTER

NATURALISTS

36, STRAND, LONDON, W.C.

(Five Doors from Charing Cross)

keep in stock every description of Apparatus, Cabinets, Books, and Specimens for Collectors of

BIRDS' EGGS, BUTTERFLIES AND MOTHS, &c.

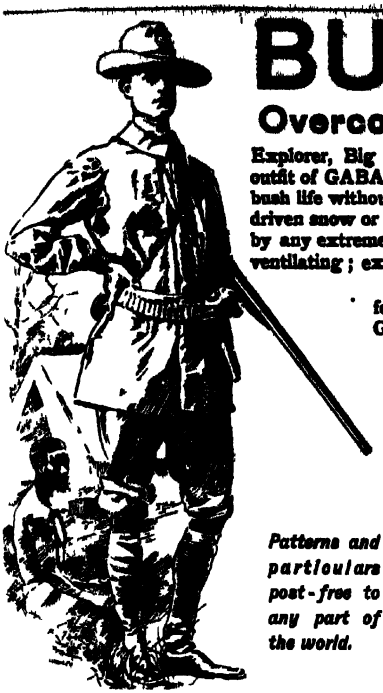
Price List sent post-free on application.

BURBERRY

Overcoats, Suits and Tents.

Explorer, Big Game Hunter, Mountaineer or Colonial with an outfit of GABARDINE has that which will stand the rigours of bush life without showing signs of wear, and keep out blizzard-driven snow or tropical downpours. The proofing is not affected by any extreme of climate; it is wind-proof yet faultlessly self-ventilating; extremely light, yet so strong as to be untearable.

Such union in numbers of the great essentials for comfort in camp life is to be found in GABARDINE AND GABARDINE ONLY.



GABARDINE SUIT.

Patterns and particulars post-free to any part of the world.



GABARDINE TENTS.
Extremely light, imperishable, and non-absorbent.

BURBERRYS, 30 to 33, Haymarket, LONDON.

J. & J. LEIGHTON, BOOKSELLERS AND BOOKBINDERS,

ESTABLISHED 1798.

40, BREWER STREET,
Golden Square, Regent Street, London, W.

Illuminated MSS., Incunabula and other Early Books with Wood-cuts, Bookbindings of Historical and Artistic Interest, etc., etc.

ILLUSTRATED CATALOGUE, 7,500 items, with upwards of 2,060 facsimile reproductions in line and half-tone, with full descriptions and bibliographical information.

SPECIMEN PART WITH PROSPECTUS, POST FREE ON APPLICATION.

ORIENT CRUISES TO SUNNY LANDS.

PORTUGAL
SPAIN
MOROCCO
ALGERIA
GREECE
ASIA MINOR
TURKEY
EGYPT
MALTA

By the

S.S. "ORMUZ," 6465 tons register.

FROM MARSEILLES—

9th April to 22nd April.

Fares from 13 to 65 Guineas.

Managers { F. GREEN & CO. / ANDERSON, ANDERSON & CO. } Head Office: Fenchurch Avenue, London, E.C.

For Passage apply to the latter firm, at 5, Fenchurch Avenue, London, E.C.; or to the West End Branch Office, 28, Cockspur Street, S.W.

NOTICE.

INSTRUCTION FOR INTENDING TRAVELLERS.

Under the authority of the Council of the R.G.S.

Arrangements have been made for the instruction of intending travellers in the following subjects:—

Surveying and Mapping, including the fixing of positions by Astronomical Observations. By Mr. E. A. Reeves, F.R.A.S., Map Curator of the Society.

Geology, including practical training in the field. Under the superintendence of the Director-General of the Geological Survey.

Botany. Under the superintendence of the Director, Royal Gardens, Kew.

Zoology.

Anthropological Measurements. Under the superintendence of Dr. J. G. Garson, Anthropological Institute.

Photography. By Mr. John Thomson, Author of 'Photographic Illustrations of China and its People,' and other works.

Meteorology. By Dr. H. R. Mill.

Outfit and Health. Dr. Charles F. Harford, Secretary of the Travellers' Health Bureau.

The Lessons are given on days and at hours arranged between the Instructor and the pupil. Tickets for the lessons, at 2*s.* 6*d.* for each hour's lesson, must be previously procured at the Offices of the Society.

Silvertown

India Rubber, Ebonite, & Gutta Percha Goods

of all Descriptions.

WATERPROOF GARMENTS and FABRICS.

The India Rubber, Gutta Percha & Telegraph Works Co.,

Limited.

Head Offices - - 106, CANNON STREET, LONDON, E.C.

Works - - - - SILVERTOWN, LONDON, E.

BRANCHES:

HOME: Belfast, Birmingham, Bradford, Bristol, Cardiff, Dublin, Glasgow, Liverpool, Manchester, Newcastle, Portsmouth, Sheffield.

ABROAD: Adelaide, Brisbane, Buenos Ayres, Bulawayo, Calcutta, Christchurch (N.Z.), Durban, Johannesburg, Melbourne, Perth (W.A.), Sydney.

CLARKSON'S

SECOND-HAND OPTICAL MART,

338, HIGH HOLBORN, W.C.

(*Opposite Gray's Inn Road*).

Sextants, Theodolites, Surveyors' Instruments, Prism Binoculars, Telescopes, and other Second-hand Optical Instruments by the best makers.

Telephone: 2140, Holborn.

All communications respecting Advertisements in the

"GEOGRAPHICAL JOURNAL"

to be sent to

G. STREET & CO., LTD.,

8 BERLE STREET, LINCOLN'S INN, W.C.

Use Odourless or Germicidal

FLORIGENE

(A Registered Name suggested by Floor-Hygiene)

On all School, Laboratory, Library, Museum, Studio, Office, and other Floors—either Wood, Linoleum, Stone, Concrete, or Polished, &c. —for the anhydrous

LAYING of DUST.

Each application lasts for two to six months, according to wear. The ordinary daily sweeping alone required to clean the floors—no scrubbing (*unless preferred*) or sprinkling of any kind—therefore no injurious moisture.

The "DUST-ALLAYER" Co.,

65, Queen Victoria Street, London, E.C.

Contractors to Admiralty, War Office, H.M. Office of Works, &c.

COOK'S TOURS.

INDEPENDENT TICKETS available at any time on nearly every Railway, Steamship and Coach throughout the World.

Pleasure Cruises. Select Cruises by first-class Steamers.

Ocean Travel. Passages at Lowest Rates to United States, Canada, South Africa, Egypt, India, China, Japan, Australasia, etc.

Inclusive Independent Travel. The acme of travel without trouble is attained by the above method. By it the traveller journeys with absolute independence, but with every detail arranged beforehand, and practically every expenditure provided for. Write for explanatory prospectus.

Select Conducted Parties. Leave chief European Cities at frequent intervals throughout the Season.

Popular Holiday Tours. Providing travel ticket and hotel expenses, leaving absolute freedom of movement.

Banking and Exchange. Foreign moneys exchanged. Letters of Credit and Circular Notes issued.

Baggage and Goods. Collected, stored and forwarded.

FREE ASSISTANCE OF COOK'S INTERPRETERS at the principal Stations and Seaports.

Hotel Coupons. Hotel Coupons are issued from 7*s.* 6*d.* to 16*s.* per day, available at one or more of the principal hotels in each of the chief cities, towns, and places of Tourist resort in Great Britain, and on the Continent. Full particulars are given in the *Traveller's Gazette*, 8*d.* monthly; by post, 5*d.*

THOS. COOK & SON,

CHIEF OFFICE:

Ludgate Circus, LONDON.

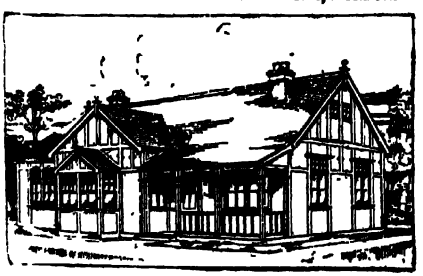
BRANCHES THROUGHOUT THE WORLD.

W. HARBROW,

IRON BUILDING WORKS,

S. Bermondsey Station, S.E.

TELEGRAMS—"ECONOMICAL, LONDON." TELEPHONE—HOP. 17.



DESIGN No. 287.

BUNGALOW, specially designed for Tropical Climates. Excellently well ventilated. Large Living Room, Four Bedrooms, Scullery, and Store.

PRICE: Delivered F.O.B. London, prepared for re-erection, including all key plans, **£189.**

Ant-proof foundation columns and steps provided at an extra cost of **£21.**

DESIGN 139a.

BUNGALOW, containing Drawing-room, Dining-room, Three Bedrooms and usual Offices.

Constructed of timber framework, roofing red diagonal asbestos tiles, walls "Rough Cast" plastering.

PRICE £280,

including foundations, chimneys, and fittings.



100-page Catalogue of Churches, Chapels, Mission Halls, Bungalows, Cottages, Billiard Rooms, Stores, Rifle Ranges, Club Rooms, Farm Buildings, Sheds, Gymnasiums, Aeroplane and Motor Garages, &c., **Post Free** on mentioning this publication.

Special Export Catalogue. Manufacturer of every description of Church Furniture and Joinery, Buildings Shipped and Erected in any part of the World.

ROYAL GEOGRAPHICAL SOCIETY.

THE SOCIETY'S PUBLICATIONS.

THE GEOGRAPHICAL JOURNAL. Issued Monthly. Delivered free to all Fellows; price to Non-Fellows, 2s.

GENERAL INDEX TO THE FIRST 20 VOLUMES OF THE GEOGRAPHICAL JOURNAL, 1893–1902. 660 pages, double columns. Price, to Fellows, 6s. 6d. net; to Non-Fellows, 10s. 6d.

JOURNAL OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1830–1880. 50 volumes, 8vo. Price, to Non-Fellows, £1 per vol. net; to Fellows, 15s. per vol.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1855–1878. 23 volumes, 8vo. In parts, to Non-Fellows, 1s.; to Fellows, 9d. per part.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (NEW SERIES), consists of 14 volumes, extending from 1879 to 1892.

Each volume covers on an average 640 pages, the selling price being 18s. per volume. These volumes constitute a record of exploration and geographical work in all parts of the world. In the 14 volumes there are some 350 maps, besides numerous illustrations of characteristic scenery in the least-known parts of the world. It is believed that a complete set of the *Proceedings* would be a valuable addition to public libraries and other institutions, while many private individuals might wish to have the volumes. The series is now offered, bound in cloth, at £6 per set.

SUPPLEMENTARY PAPERS.

Containing a large number of Memoirs and Narratives of considerable length, besides several valuable Bibliographies; over 30 Maps and numerous Illustrations. Sold for half price, £2 for the four volumes.

HINTS TO TRAVELLERS.—The ninth revised edition, edited, under a Committee of the Council, by E. Reeves, F.R.A.S., Map Curator and Instructor to the Society. Price 15s. net; to Fellows, at the House of the Society, 10s.

TRIGONOMETRY—PLANE AND SPHERICAL. Specially arranged for the use of Students attending the Royal Geographical Society's course of Instruction. By E. A. Reeves, F.R.A.S. Price 5s. net.

HINTS ON OUTFIT FOR TRAVELLERS IN TROPICAL COUNTRIES. By Charles Forbes Harford, M.A., M.D. Price 1s. 2d. net.

CATALOGUE OF THE LIBRARY OF THE R.G.S. Edited by Dr. H. R. Mill. Price, to Fellows, 2s. 6d. net; to Non-Fellows, 5s.

THE YEAR-BOOK OF THE SOCIETY. Issued annually. Price, to Non-Fellows, 2s. 6d.; Fellows, 1s.

SYLLABUSES OF INSTRUCTION IN GEOGRAPHY. I. In Elementary Schools. II. In Secondary Schools. Single copies gratis on application at 1, Savile Row, W.

EXTRA PUBLICATIONS.

THE FIFTY YEARS' WORK OF THE ROYAL GEOGRAPHICAL SOCIETY. By Sir Clements R. Markham, K.C.B., F.R.S., President. 255 pp. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

THE LANDS OF CAZEMBE. LACERDA'S JOURNEY TO CAZEMBE IN 1798. Translated and annotated by Captain R. F. Burton. 271 pp., with Map. Also Journey of the Pombeiros, P. J. Baptista, and Amaro José, across Africa from Angola to Tette on the Zambese. Translated by B. A. Bradle. And a *Résumé* of the Journey of MM Monteiro and Gamitto. By Dr. C. T. Beke. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net

THE TOPOGRAPHY OF THE BATTLE OF PLATÆA. By G. B. Grundy, B.A. Price, bound in half-calf, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

NOTES ON THE KURIL ISLANDS. By Captain H. J. Snow. 8vo, 88 pp., with two large Charts, revised by Captain Snow. Price, in boards, to Non-Fellows, 4s. net; to Fellows, 2s. net.

EASTERN PERSIAN IRAK. By General A. Houtum-Schindler. 8vo, 132 pp., with Map. Price, to Non-Fellows, 5s. net; to Fellows, 2s. net.

A JOURNEY ON THE UPPER MEKONG, SIAM. By H. Warington Smyth. Sixty Illustrations and three Maps. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 4s. net.

BIBLIOGRAPHY OF ALGERIA, FROM THE EXPEDITION OF CHARLES V. IN 1511 TO 1887. By Sir R. L. Playfair. Price, to Non-Fellows, 7s. 6d.; Fellows, 5s. net. [net.

EDUCATIONAL REPORTS. By Dr. J. Scott Keltie. Price, to Non-Fellows, 5s.; to Fellows, 2s. 6d.

SUPPLEMENT TO THE BIBLIOGRAPHY OF ALGERIA, FROM THE EARLIEST TIME TO 1895. By Sir Lambert Playfair, K.C.M.G. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

MAP OF THE KARAKORAM HIMALAYAS. In two sheets, with text. By Sir W. Martin Conway, M.A. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

SURVEYING AND EXPLORING IN SIAM. By James McCarthy. Large Maps of Siam and many Illustrations. 236 pp. 8vo. Price, to Non-Fellows, 10s. 6d. net; to Fellows, 6s. 6d. net.

THE DISTRIBUTION OF RAINFALL OVER THE LAND. By Dr. A. J. Herbertson. Price, to Non Fellows, 5s. net; to Fellows, 2s. 6d. net.

ON THE RESULTS OF A DEEP-SEA SOUNDING EXPEDITION IN THE NORTH ATLANTIC DURING THE SUMMER OF 1899. By R. S. Peake, M.Inst.C.E. With Notes on Temperature, Deep-Sea Deposits, &c. By Sir John Murray, K.C.B., F.R.S. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

ARCTIC PAPERS FOR THE EXPEDITION OF 1875. A selection of Papers on Arctic Geography and Ethnology. Reprinted and presented to the Arctic Expedition of 1875, by the President, Council, and Fellows of the Royal Geographical Society. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 5s. net.

THE ANTARCTIC MANUAL, FOR THE USE OF THE EXPEDITION OF 1901. Edited by George Murray, F.R.S. 602 pp. royal 8vo. Price, to Non-Fellows, 15s. net; to Fellows, 10s. net.

JOURNEY TO LHASA AND CENTRAL TIBET. By Sarat Chandra Das, C.I.E. Edited by the Hon. W. W. Rockhill. Maps and Illustrations. 285 pp. 8vo. Price, bound in cloth, to Non-Fellows, 10s. 6d. net; to Fellows, 7s. net.

NEW MAP OF THE RIVER CONGO, in Ten Sections on Five Sheets. Scale 1 : 500,000 (8 miles = 1 inch). By the Rev. George Grenfell. In small portfolio, with Memorandum. Price, to Non-Fellows, 16s. net; to Fellows, 8s. net.

ON RECENT CONTRIBUTIONS TO OUR KNOWLEDGE OF THE FLOOR OF THE NORTH ATLANTIC OCEAN. By Sir John Murray, K.C.B., F.R.S., and R. E. Peake, M.Inst.C.E. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

AN EXPEDITION INTO THE CENTRAL TIAN-SHAN MOUNTAINS. By Dr. Gottfried Merzbacher. Price, to Non-Fellows, 12s. net; to Fellows, 8s. net.

MAP OF TIBET. New edition, 1906. Price, to Fellows, 8s. net; to Non-Fellows, 5s. net.

GEOGRAPHICAL DISTRIBUTION OF VEGETATION IN SOMERSET. By Dr. C. E. Moss. Price, to Fellows, 2s. 6d. net; to Non-Fellows, 5s. net.

BIBLIOGRAPHY OF TOPOGRAPHICAL AND GEOLOGICAL WORKS ON THE PELOPONNESIAN FIELDS. By R. T. Günther. Price, to Fellows, paper covers, 2s. 6d., boards, 3s. net; to Non-Fellows, paper covers, 5s., stiff boards, 6s. net.

NATIONAL ANTARCTIC EXPEDITION, 1901–4. Charts of the Expedition, with Memoir by Lieut. G. F. A. Mulock, R.N. Price, to Non-Fellows, 12s. 6d. net; to Fellows, 9s. net.

MOUNTAIN PANORAMAS FROM THE PAMIRS AND KWEN LUN. With Introduction and Descriptions by Dr. M. Aurel Stein. Price, to Non-Fellows, £1 net; to Fellows, 14s. net.

BATHYMETRICAL SURVEY OF THE FRESHWATER LOCHS OF SCOTLAND. Under the direction of Sir John Murray, K.C.B., F.R.S., and Laurence Pullar, F.R.S.E. Maps and Illustrations. Price, to Fellows, 15s.; to Non-Fellows, £1s. net.

MACMILLAN AND CO.'S NEW BOOKS.

Administrative Problems of British India. By JOSEPH CHAILLEY, Member of the French Chamber of Deputies. Translated by Sir WILLIAM MEYER, K.C.I.E. 8vo. 10s. net.

The Gates of India. Being an Historical Narrative. By Colonel Sir THOMAS HOLDICH, K.C.M.G., K.C.I.E., C.B., D.Sc. With Maps. 8vo. 10s. net.

TRAVEL AND EXPLORATION.—"Sir Thomas Holdich's book shows the romance and interest of the land which lies between Persia and India . . . a work which is emphatically one which Englishmen should buy and read."

THIRD EDITION, THOROUGHLY REVISED.

The Burman: His Life and Notions. By SHWAY YOE, Subject of the Great Queen. Third Edition. 8vo 10s. net.

The Statesman's Year-Book for the Year 1910. Edited by J SCOTT KELTIE, LL.D, with the assistance of I. P. A. RENWICK, M.A, LL.B. Crown 8vo. 10s. 6d. net. *[Shortly*

Accidents of an Antiquary's Life. By D. G. HOGARTH, Author of 'A Wandering Scholar,' &c. With 40 Illustrations from Photographs taken by the Author and his Companions. 8vo. 7s. 6d. net.

Mr Hogarth's experiences cover a wide area in the Levant, including Greece, Asia Minor, Crete, Egypt, and North Africa

Papuan Fairy Tales. By ANNIE KER. Illustrated. Extra crown 8vo. 5s net.

DAILY TELEGRAPH.—"The many tales which Miss Ker has here collected form a valuable and deeply interesting addition to the folk-lore of savage peoples"

MACMILLAN &CO., LTD., LONDON.

ROYAL GEOGRAPHICAL SOCIETY.

NEW EXTRA PUBLICATIONS.

"Researches on Ptolemy's Geography of Eastern Asia (Further India and Indo-Malay Archipelago)."

By Colonel G. E. GERINI, M.R.A.S.

Published in conjunction with the Royal Asiatic Society. 970 pages, with maps. Price 15s. net; to Fellows, 12s

This is the result of many years' investigation in Further India and the Indo-Malay Archipelago, by Colonel Gerini, and is one of the most important contributions that have been made to the literature of Ptolemy's Geography.

New Map of Eastern Turkey-in-Asia, Syria, and Western Persia.

On the scale of 1:2,000,000, or 32 miles to an inch, with accompanying text, in case, with pocket for maps. Price to Fellows, unmounted, 5s net, mounted in cloth, 6s. 6d. net; to Non-Fellows, unmounted, 8s. 6d. net, mounted, 10s.

This map is based on the most trustworthy recent surveys and explorations by travellers of all nationalities, and may be regarded as the most complete map of the region available.

Copies may be obtained at the Royal Geographical Society, 1, SAVILE ROW, LONDON, W.

CLOTHED WITH AIR

When buying a Ventilated Garment, do not simply ask for Cellular, but ask for

AERTEX Cellular

LOOK FOR THIS OVAL LABEL

THE CELLULAR CLOTHING Co. LTD. AERTEX LONDON

LOOK FOR THIS OVAL LABEL

so as to make certain you get the genuine and original make.
BEWARE OF IMITATIONS SOLD UNDER SIMILAR NAMES.

AERTEX Cellular Garments are made from a cloth composed of small cells, in which the air is enclosed. The body is thus protected from the effects of outer heat or cold, while the action of the pores of the skin is not impeded.

ILLUSTRATED PRICE LIST of full range of AERTEX CELLULAR goods for Men, Women, and Children, with list of 1,500 Depots where these goods may be obtained, sent Post Free on application to THE CELLULAR CLOTHING Co., Ltd., Fore Street, London, E.C.

ROBERT SCOTT, Ltd., 8, Poultry, Cheapside, E.C.
OLIVER BROS., Ltd., 417, Oxford Street, W.

USED BY DOCTORS and the PUBLIC for OVER HALF-A-CENTURY.

Dr. J. Collis Browne's Chlorodyne

The ORIGINAL and

The Best Remedy Known for

COUGHS, COLDS, ASTHMA, and BRONCHITIS.

Acts like a Charm in

DIARRHŒA, CHOLERA, and DYSENTERY.



ONLY GENUINE.

Admitted by the Profession to be the **MOST VALUABLE REMEDY** ever discovered.

Effectually cuts short all attacks of **SPASMS.**

The only Palliative in **NEURALGIA, TOOTHACHE, GOUT, RHEUMATISM.**

Convincing Medical Testimony accompanies each bottle.

SOLD IN BOTTLES BY ALL CHEMISTS,
at 1/1½, 2/9, and 4/6 each.

INDEX TO ADVERTISEMENTS.

Where no number is given, the Advertisement does not appear this month.

PAGE

Account Book Makers.
Brown & Rowley 6

Bookbinders, Booksellers, &c.
Leighton, J. & J. 7
Sotheran & Co. ..... *Cover* 2

Boots and Shoes.
Dowie & Marshall 13
Goodyear-Welted 13

College.
Thames Nautical Training 13

Cutlery.
Hill & Son 13

Electrical Engineers, India Rubber, Gutta Percha, & Telegraph Works Co., Ltd. ... 8

Electric Lighting.
Tredegar & Co. 13
Wakefield & Co. 5

Filters.
Berkefeld 5
Doulton & Co., Ltd. 3

Foods for Travellers.
Bovril 5
Oxo 14
Red, White & Blue Coffee 3

Fountain Pens.
Waterman's Ideal Fountain Pen 13

Furniture and Floor Polish.
Ronuk, Limited 16

Hotels and Restaurants.
Hôtel Métropole 15
Hotel Seafield, Arcos 13
Hotel Victoria, Bala 15

Instruments for Travellers.
Cary, Porter, Ltd. 3
Clarkson & Co. 3

Insurance.
Eagle Insurance Co. 13
London and Lancashire 13
Scottish Provident Institution 13
Scottish Widows' Fund ..... *Insert*

PAGE

Medicines & Medicine Cases.
Brown, Dr. Collis 13
Burroughs Wellcome & Co. 13
Dinneford & Co. ..... *Cover* 3
Evans, Lescher & Webb, Ltd. 13
Mansfield 13

Naturalists.
Watkins & Doncaster 6

Outfitters.
Callaher Clothing Co. 13
Dowie & Marshall 13
Griffiths, McAllister & Co. *Cover* 3
Silver, S. W., & Co., and Benjamin Edgington ..... *Cover* 4
Thresher & Glenny 13
Tucker, Joseph 13

Pencils.
Koh-i-noor 3

Photo Engravers.
Bale, Sons, & Danielsson, Ltd. *Cover* 2

Photographic.
Burroughs Wellcome & Co. 13
Newman & Guardia 13
Westminster Photo Exchange ... 5

Portable Buildings.
Harbrow, W. 9

Publishers.
Constable & Co., Ltd. 13
Heinemann, Wm. 13
Macmillan & Co., Ltd. 11
Murray 13
Philip, G., & Son, Ltd. 13
Potter, Wm. 6
Stanford, Edward 5
Travel and Exploration 3
Witherby & Co. 3

Railways.
Great Central Railway 13
Great Eastern Railway 13

Razors.
Kropp Razor ..... *Cover* 2

PAGE

Soaps.
Wright's Coal Tar 4

Sporting Outfits.
Burberrys 7

Stores for Expeditions, &c.
Griffiths, McAllister & Co. *Cover* 3
Silver, S. W., & Co., and Benjamin Edgington ..... *Cover* 4
Sprott's Patent, Ltd. 13
Tucker, Joseph 13
Wilkinson Sword Co. 13

Stoves.
Penn, Wm., & Co. 15

Tailors.
Skinner & Grant 15

Tents.
Burberrys 7
Nugent Bros. & Co., Ltd. 13
Silver, S. W., & Co., and Benjamin Edgington ..... *Cover* 4
Tucker, Joseph 13

Tobacco.
Player & Sons 13

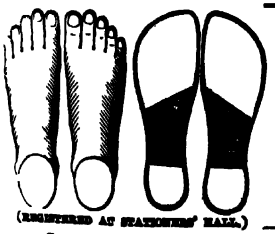
Tours and Excursions.
Cook, T., & Son 9
Orient Line 7

Turkish Baths.
Nevill's, Charing Cross ..... *Cover* 3

Typewriters.
Blick 14
Oliver Typewriter Co., Ltd. 13
Remington Typewriter Co. 13

Wines and Spirits.
Deutz & Geldermann 13
Haddstock, Charles 13
Martell & Co. 13

BOOTS FOR EXPLORERS.



(REGISTERED AT STATIONERS' HALL.)

DOWIE & MARSHALL

(Established 1894)

Have for many years made a special study of the various kinds of boots required for different climates, and they have had the gratification of pleasing many Travellers, including members of the R.G.S., from the time of Dr. John Rae of Arctic renown to Sir H. M. Stanley, the African Explorer.

Country Customers should send, as guide to measurement, a pair of old boots and outlines of the feet.

Only the best hand-sewn Boots are made.

455, WEST STRAND, LONDON.

G.P.O. Telephone No. 9015 Central. (3 doors from Trafalgar Square.)

IF YOU ARE GOING ABROAD

CALL UPON

JOSEPH TUCKER

AND INSPECT

his large and varied stock of TROPICAL CLOTHING, CAMP FURNITURE and EQUIPMENT, STORES, and every requisite for travel and residence abroad.

79, Newington Green Road, LONDON, N.

SHIPPING AND PASSENGER AGENT,

Contractor to H.M. and the Dutch Governments.

Telegrams: "Turbuis, London."

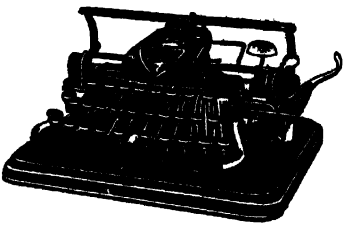
Telephone: 3181 Dalston.

TRAVELLERS

will find the "Blick" the most portable, reliable, and hardest wearing machine. It has been called the Special Correspondent's "light-weight travelling companion," and has stood the test of rough travelling through the South African veldt, the wilds of Klondyke, China, the Congo, Soudan, and "The Forbidden Land."

THE "BLICK"

ALUMINIUM MODEL.



¶ The "Blick" is the easiest Typewriter to learn—an hour does it. The ALUMINIUM MODEL is a marvel of lightness—weighs only 5 lbs. The writing is always in sight, and it is so strong and simple in mechanism that it seldom gets out of repair. In a word, it possesses the efficiency of the big cost machines at half the price.

Price Eleven Guineas. Cash Discount or Easy Terms.

Write for Booklet No. 85.

The BLICKENSDERFER CO., LD.

9 & 10, Cheapside, London, E.C.

OXO

for explorers

The great value of OXO to explorers lies in the fact that it contains the nourishment of beef in compact form. It is easily prepared and is ready in a moment. As a nourishing food in case of illness, it is unsurpassed. OXO is a scientific blend of beef extract which stimulates, and beef fibrin which nourishes.

And OXO is guaranteed pure—it is made by the OXO Company throughout from ranch to bottle. *OXO differs from other fluid beefs in that all raw material used comes from OXO's own cattle.* Not one single ounce of raw material is bought from an outside source. This is important, because the OXO Company thus have complete control over its manufacture, and are able to guarantee absolute purity and healthiness.

OXO, 4, Lloyd's Avenue, London, E.C.

The

Geographical Journal.

No. 4. APRIL, 1910. Vol. XXXV.

JOURNEYS IN KURDISTAN.*

By Captain BERTRAM DICKSON.

During my occupation of the post of H.M.'s Military Consul at Van, I availed myself of the opportunity to travel in the surrounding country. Doubtless the Society in the course of its existence has received accounts from travellers who have visited these regions, and I should like my own experiences in these parts to be regarded as merely supplementary to their reports. I have, however, as far as I am aware, covered fresh ground, and to these special experiences I shall refer later.

Before proceeding to describe particular districts or places, I will give a general description of the part of Kurdistan in which I have been travelling. There is a wide, high plateau running east from the Mediterranean across Asia Minor to the Persian frontier; it then turns south-east across Persia to Afghanistan and the Himalayas, forming the watershed between the Persian gulf and the Black and Caspian seas, and in Turkey its southern slopes are drained by the numerous branches of the Tigris and the Euphrates.

I shall confine myself to the country east of the Tigris. Several chains of mountain parallel this plateau with their spurs running in a similar direction, viz. west and east. At a rough estimate the average height of the larger of these chains may be given as 10,000 feet. In the centre of the plateau these ridges and furrows are high, grassy, rounded hills, wide apart, with large open, rich alluvial or volcanic plains between them, such as Erzeroum, Van, Gavver, Urmi, and Lahijan plains. These are dotted with agricultural villages, while the mountain slopes are used by the Kurds as pasturage for their sheep.

The Lake of Van is situated in one of these long alluvial plains, and

* Read at the Royal Geographical Society, December 13, 1909. Map, p. 480.

directly south of it is one of the biggest of these ranges, running west to the Taurus; for the sake of reference, I will call this ridge the Arnost Meleto range. South of this range the country rapidly becomes very tangled, as the ranges come closer together, and the gorges deepen; the round grassy slopes give place to Alpine crags, deep cañons, and gulches, while farther south the ridges and furrows descend like steps, getting smaller and lower till they finally vanish in the Mosul and Mesopotamian plains at an altitude of some 300 feet.

These mountain chains are what were known to the ancient Assyrians as the Mountain of Nairi, and at other times have been called the Ararat. The Bible historian probably took the account of the Ark resting on Ararat from the Chaldean legend, which made it rest on the mountains of Urartu; while local traditions, Christian, Moslem, and Yezidi (or devil-worshippers) alike make it Jebel Judi, a striking, sheer rocky Niphates, and the Mountains of Urartu; from the latter comes the name of the wall of 7000 feet which frowns over Mesopotamia. Common sense also suggests that with a subsiding flood in the plains, a boat would more probably run aground on the high ridge at the edge of the plain rather than on a solitary peak miles from the plains with many high ranges intervening.

I should think the local tradition had the greatest element of truth; there is a large Ziaret (Zijgurat or sanctuary) at the top of Jebel Judi, where every year in August is held a great *fête* attended by thousands of energetic Moslems, Christians, and Yezidis, who climb the steepest of trails for 7000 feet in the terrific summer's heat to do homage to Noah.

This mountain seems to have been held sacred at all times, and certainly it has a wonderfully awesome fascination about it, with its huge precipices and jagged, tangled crags watching over the vast Mesopotamian plain. The local villagers can show one the exact spot where Noah descended, while in one village, Hassana, they showed me his grave, the vineyard where he is reputed to have indulged over-freely in the juice of the grape, the owner declaring the vines had been passed from father to son ever since.

These chains of mountains are drained by numerous streams running east and west in the latitudinal valley to join one or other of the big affluents of the Tigris or Euphrates, and these, selecting the way of least resistance toward the south follow zigzag courses, one moment flowing east through a gently sloping valley, then, turning abruptly south, eat their way by rocky gorges through some huge ridge 10,000 feet high, then turning west to debouch into a deeper valley, and again south through a bottomless cañon, and so on to the plains to form the Tigris or Euphrates.

On the top of the plateau, many of the largest mountains are extinct volcanoes, some of them being fine specimens—Nimrūd Dagh, for example, with a perfect crater, 16 miles in circumference, and

10,000 feet high. Here, also, Sipan D, 14,000 feet, where local tradition has it the Ark bumped, and Noah exclaimed, "Sabahn Allah," "Praise God" (probably a unique case of a ship's captain praising the Almighty for running the ship aground).

The ridges south of the big ridge Arnost Meleto are formed mainly of layers of limestone, up-tilted in a northerly direction. This makes the northerly slopes more or less grassy, while the southern are precipitous crags, with corries and talus slopes at the foot. Here and there smaller ridges of sandstone and conglomerate intervene, and in some rare cases granite outcrops. Deposits of marble and of various minerals are found in many parts, and, in a few places, coal. There are also many old mineral workings. While in most cases the main strata are tilted to the north, it often happens that subsidiary ridges have been turned over the reverse way. In one or two instances the strata seems to have been pushed straight up like a table, with precipices and talus slopes all round. A notable example of this is Harakol D, a table mountain some 100 miles round, and 10,000 feet high.

As the ranges trend further south and decrease in contour, they take a very curious and regular formation, being parallel rows of jagged crags, equi-distant and of the same height, and resembling nothing so much as a big hand-saw lying on its side. As mentioned above, these are used to a certain extent by the various small Kurd tribes who winter in villages in the valleys below, and summer in tents on the slopes; but these people take a secondary place to the larger and more powerful tribes of purely pastoral nomad Kurds, who winter with their flocks in the Mosul plains, and follow the melting snows and the new grass up the hills from the lower to the higher ridges.

There is a certain amount of cultivation in the valleys. This is carried on by Armenians, Assyrians, and Ryah Kurds. South of the Arnost ridge the slopes of the valleys get too steep for agriculture on a large scale, and the villagers have to utilize every available yard of soil; the hill slopes are built up into terraces wherever there is a little earth and a possibility of leading a water channel to irrigate it. Immense labour must have been expended on these terraces, and some of them probably date back to a hoary antiquity. These latitudinal ridges and valleys, as they approach the Persian frontier, change their direction to the south-east, and in so doing seem to have got rather disintegrated, resulting in a most involved formation of mountains, gorges, spurs, and precipices where the angle occurs, with mountain torrents rushing through deep cañons in apparent violation, to the eye, of every law of gravity, and just in the direction one would least expect them to. This is the Turkish district of Hakkiari. Probably the most tangled part of this disintegrated portion is in the middle of the bend, in a district which, for the sake of reference, I will call the Herki Oramar, and this is one of the districts I intend referring to in some detail.

Character of Ground and Vegetation.—The high Arnost Meleto ridge and its immediate spurs and neighbours are grass-covered and give some of the finest sheep pastures in that part of Turkey.

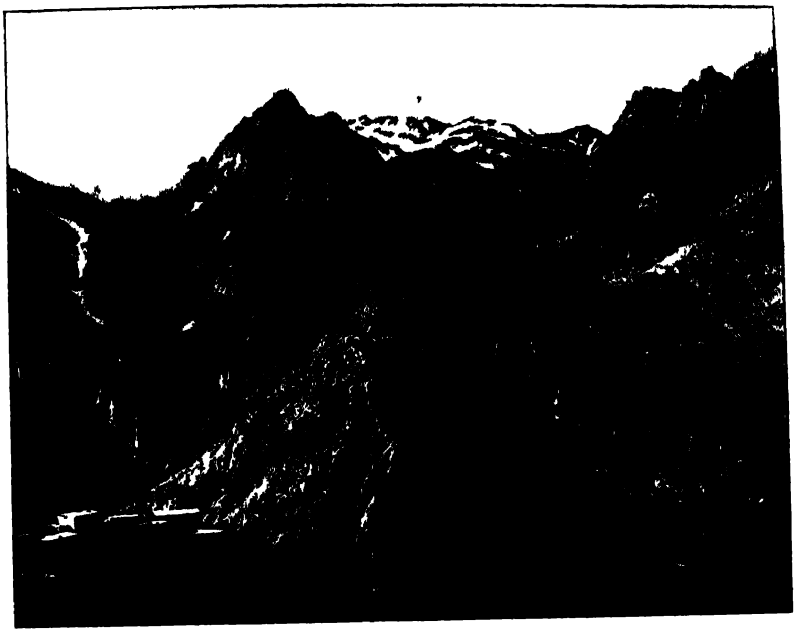
The altitude above sea-level of the valley bottoms south of the Arnost range decreases very rapidly, so that the villages in these valleys have quite a different climate to those north of the Arnost ridge, and their produce, therefore, embraces a wider variety: walnuts, peaches, almonds, tobacco, millet, rice, and maize being the most common. South of the Arnost range the grassy slope gives place to steep, bare, rocky ridges and precipices, with crags and talus, these becoming more accentuated as one approaches the disintegrated Herki Oramar district.

The snows lie late into July on the top of these ranges, so that there is not much vegetation above a certain altitude. On the southern slopes, at about 5000 feet, one finds straggling cypress, juniper and dwarf oak, while at a little lower altitude the oak flourishes better, and at about 4000 feet I have seen some really fine oak, beech, and hawthorn forests. However, the majority of the southern slopes are so scarped and bare of soil that very little vegetation can exist on it.

On the Persian frontier ranges, in the lesser Zab valley south of Lahijan, where the eastern slopes of the mountain have a more gentle declination, there are some fine forest belts at about 3000 to 4000 feet. Lower than this, where the slopes become steep, the ground gets quickly parched, and only stunted oak, mimosa, and oleander flourish to any great extent, though here and there one finds, for various reasons, a level strip of alluvial soil which retains moisture, where luxuriant vegetation will be found: wild mulberries, fig trees, laburnum, hawthorn, willow, etc.

As one approaches the plain all trees disappear, and only the oleander, mimosa, and willow are to be found along the river-banks. The plains are not at present irrigated, and the inhabitants take advantage of the winter rains to sow their crops, which quickly grow and ripen when the rains stop and the Mesopotamian spring sets in. They harvest in April, and the rest of the year the plains are virtually a desert. A curious feature in this latitudinal valley is the immense difference in vegetation between the north and south side of the valley, owing, I suppose, to the slope of the strata giving more moisture to the south side.

Peoples.—Like most other parts of Turkey, these districts are inhabited by races of varying nationalities and religious denominations, each separate village maintaining its own characteristics independent of its next-door neighbour. In the high northern plateau there are Kurd and Armenian, with a sprinkling of Assyrians and Yezidis. South of the Arnost ridge, the Armenian practically disappears; in fact, I am told that the Armenians cannot live down in the plains. Their place is taken by the Assyrians.



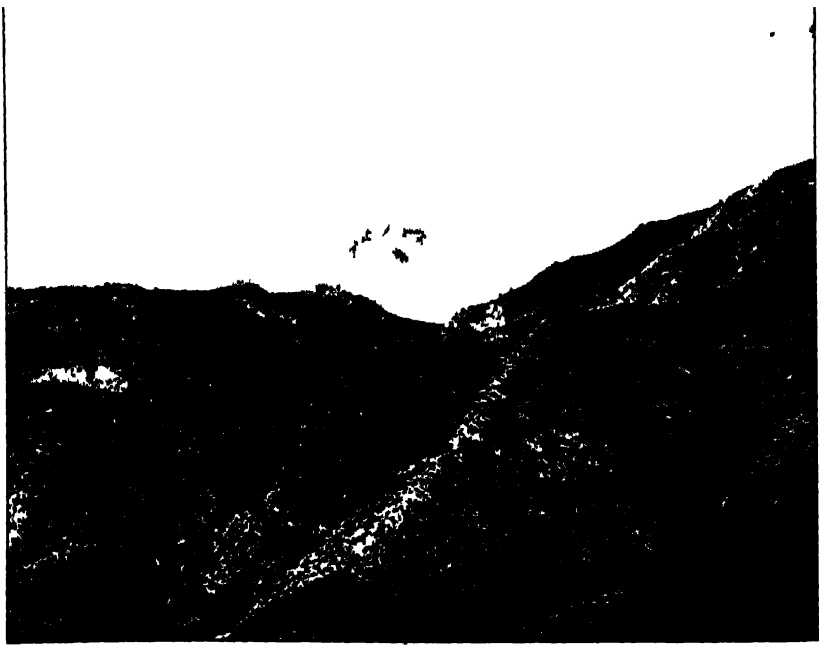
CHAIN OF JELU D AND ORAMAR FROM SOUTH



BAND OF ARMENIAN REVOLUTIONARIES, VAN PLATEAU.



SAT D FROM NORTH-WEST



SAT D FROM SOUTH-EAST

Further south, on the edge of the Mosul plain, one finds the Yezidis, or so-called devil-worshippers, while further west are the Jacobites. In Turkey, people are known by their religion and not by their nationality. Here and there in the mountains of Hakkiari, one finds villages of Jews, who have been there since the times of the Assyrian conquests in Palestine, and, I believe, retain their native religion and customs.

Authorities differ as to the origin of the Armenians and the Kurds. The Kurds themselves declare they came from Arabia, and their legends say they are the descendants of Solomon by his concubines. All Moslems like to trace their descent from Solomon. They are a heterogeneous lot, and I should imagine an anthropologist would see traces of Mongol, Scythians, Cimmerian, Gaul, Roman, Greek, and what not in them. There is no characteristic type in the north of Kurdistan, though, as one goes further south, a type seems to become more pronounced. This is Semitic, tall, sallow, and straight-haired. A curious personal trait is noticeable, the Kurds wearing moustaches, but very rarely beards. They are not a cleanly race, and I believe they shave their beards, as they shave their heads, so as to keep off vermin.

The Kurds are divided into several large divisions, with countless subdivisions, or tribes, under petty chiefs, or aghas. They are a quarrelsome lot, perpetually at war with each other on account of raids or blood-feuds, and in their utter want of cohesion lies their weakness. There are three varieties of Kurds: nomads, semi-nomads, and sedentary. The sedentary, as their name implies, live in villages on their own lands, tilling the ground while their flocks graze on the surrounding hills, and wintering their sheep in their houses. The sedentary are mostly to be found in the valleys south of the Arnost ridge, and here and there on the high plateau north.

The semi-sedentary Kurds do little cultivating, but own large flocks, live in tents on their own hills in the summer, and winter in villages in the valleys. These tribes are mostly found north of the Arnost ridge.

The purely nomad Kurds live all the year round in tents; own large flocks of sheep, goats, mules, and horses, but no land. They winter in the Mesopotamian and Mosul plains, and have the right, by ancient custom, to certain well-defined summer pastures on the various spurs up to and including the Arnost ridge, with an ancient right-of-way to get to these in their annual migration to and from the plains. They are often put to no little trouble in insisting on this right-of-way, a powerful agha of a sedentary tribe probably exacting toll on them. The migration season is an anxious time on the hills, leading, as it often does, to much bloodshed.

The character and habits of these three sorts of Kurds vary considerably; in fact, the only things common to them are their religion,

language, and love of a gun and cartridges. The Kurds of the high plateau wear a tight tunic, with pleated ballet skirts, tight trousers, and high boots, and are always mounted and armed with rifle, bandoliers, and short khanja, or dagger. These are the Kurds that were armed by the late Sultan as "Hamidieh," being employed as a sort of yeomanry cavalry, in imitation of the Russian cossacks. They are thus well armed, for this country, with martinis. Their costume includes a white conical cap and black cashmere scarf, with tassels wound round it.

In the mountains south of the Arnost ridge, horses are useless and nearly unknown, and the tight costume of the cavalier gives place to a looser garb, more appropriate for mountain climbing; a loose skirt, and trousers like sacks, with a short sleeveless jacket of thick white felt, sandals, and a white felt conical cap, with a blue-and-white bird's-eye scarf wound round it, a coloured sash tastefully arranged round the waist, and a huge silver-handled "khanja." The pure nomads now pretty generally affect a sort of nondescript imitation of the Arab costume with the addition of Kurd khanja. They look on themselves as the aristocrats among the Kurds, and some of them are fine-looking fellows.

The Assyrians are supposed to be survivors of the great Assyrian Empire, whose ancestors practically took refuge in the fastnesses of these mountains from the various invasions and desolations which took place in the plains at the time of the Mohammedan conquest. They were Christians at that time, having two sects, Nestorians and Jacobites; they have since added Chaldeanism or the Church of Rome, and their internecine jealousies are stronger than the Christian-Moslem hate. Last year a miracle was alleged to have been performed in the mountains which illustrates this well.

A Kurd came to the Sheikh of Shemsdinan (a certain powerful chief) and said that he had a cock which had spoken on three separate occasions, saying, "Christ's religion is the only faith." He asked the sheikh whether he should turn Christian or kill the cock as an infidel. The sheikh, after much thought, decided that they must keep the cock to see which of Christ's religions it said was the true religion, and in the meanwhile they would continue to be Moslems.

The mountain Assyrians are, generally speaking, fairer than the Kurds, pale and colourless, probably owing to the prevalence of malaria. Many of them show traces in their features of their ancient Turanian or Mongol origin. In some of the valleys they wear their hair in two-plaited pig-tails, while a curious conical felt cap adds to their Mongolian appearance. Otherwise they wear the same clothes as their neighbouring sedentary Kurds. The mountain Assyrians are mostly Nestorians, and they own a supreme chief—their patriarch, Mar Shimun, or Saint Simon, a hereditary office, descending from uncle to nephew, the holder being a celibate. They are divided up into numerous

tribes or clans under maliks, the villages in one valley, generally speaking, forming one clan.

Some of these clans near the Turkish Government posts pay taxes direct to the Government and are called rayah, and are not supposed to be allowed to carry arms. Others pay tribute to Mar Shimun, who, in turn, pays a tribute to the Sultan; these latter are called "Asshiret clans," carry arms, and have little to distinguish them from their wild Kurdish neighbours, with whom they are perpetually at war. They are fairly well able to take care of themselves, are just as wild and keen on raiding as the Kurds, have perpetual blood-feuds and inter-tribal warfare among themselves and the Kurds: it often happens that a Kurd and an Assyrian clan will ally themselves against another Kurd tribe or against another Kurd and Assyrian combination.

The Assyrians and the Kurds, especially the tribes whose habitat is the mountains, are very patriarchal in their habits and customs. While among them, it is easy to imagine one's self watching a chapter in the Old Testament; with the exception that the rifle takes the place of the sword and spear, nothing is altered: the clothes, food, domestic economy and utensils, customs, and manner of address are probably the same to-day as in the time of Abraham or Hamurabi. Western civilization has not yet reached them, or at least made no appreciable impression.

One old Mulla, who had listened with apparent interest to my description of civilization, motors, trains, etc., at the conclusion told me he supposed we needed such things; they didn't, as they had donkeys and mules in his country.

Now and then, however, one gets a rude shock just when it is least expected. For instance, one evening I camped in a village of a certain Abder Rahman Agha, chief of the Shernakli Kurds. He and a relative of his were fighting for the chieftainship of the tribe, and both were barricaded in their respective fortresses in the same village, watching each other.

My friend, Abder Rahman came to see me in my tent, and, like all Kurds, admired my rifle and prismatic glasses, and asked me for them, unsuccessfully, ditto cartridges; he then asked me for dynamite with which to blow up his enemy's fort. I asked him in turn what made him think I should carry about explosives? He then said that he had heard that European travellers often carried dynamite cartridges to kill fish with. I thought this showed a curious knowledge of the methods of fish-poachers. He asked me for sundry other things, showing no bashfulness about it; so as I had light baggage and a long journey before me, I was not bashful about refusing, and all he got from me eventually was a couple of liver pills.

The food of these people is probably the same as in the patriarchal times—bread, curdled milk, and cheese, nuts, and dried fruits; the

only modern innovation is tea and sugar from the samovar, sometimes found in the chief's houses, and which has to be served to a guest preparatory to a meal. This generally entails a long wait, as a fire has to be lit and burned down first to obtain charcoal embers with which to heat the samovar. This requires some time, and no meal can be served until after the tea has been served to every one.

The women do all the housework, cooking, baking, drawing water and wood, etc, but do not wait on the men. The men do the field-work, tilling and sowing and irrigating in the spring, and harvesting in summer; the rest of the year they are idle, and that may account for the amount of quarrelling which goes on. One does not see very much of the women in the East, though the Kurds do not shut them up like the Turks, and they do not veil.

The nomad women seem freer, and are often quite forward and talkative. Their costume is rather nondescript, and usually very dirty and ragged, consisting of baggy trousers, with a sort of long coloured cotton chemise over them, and probably a loose jacket, while the hair is plaited in many plaits, a small round cap with beads on it is worn on top, and a loose handkerchief over all. On great occasions a few beads or silver necklace, bracelets, and sometimes silver or gold chains are wound round the head.

Usually, in Kurdistan, the natives live for security in villages for fear of attacks from neighbouring tribes, etc. In some of these deeper gorges and valleys in the mountains, however, the difficult nature of the country ensures a certain immunity from attack, and there one finds solitary farms and straggling hamlets, advantage being taken of every spare inch of soil on the rocky hillside.

The villages are built on the staircase principle, house over house, the roof of one being the courtyard of the next one. The houses and villages in the Herki Oramar district are the most substantial in construction I have found in the mountains. They are built of stone with lime cement—a rare occurrence in Kurdistan—while the supports of the doorways are often formed of one solid arched stone.

The houses are the usual mountain Kurd type, two-storied, built half into the slope of the hill, the lower rooms used as stables, depôt, kitchen, etc., all very dark, with only a few loopholes for windows. The upper storey opens towards the south, and is used as a granary in winter and as a living room in summer. The roofs are made of rough poplar beams laid across the walls; branches are placed over these, and then grass and mud and earth rolled in with a stone roller. These roofs are very solid, and are usually the only level spaces to be found for miles, and are therefore used for many purposes, threshing among others; in fact, the eastern roof is rather proverbial, and we have camped a good many nights on roofs. They are also usually the cleanest place in the village. These mountain villages are a great improvement on the ones in the



MAIDAN SULIMANIA



A TYPICAL GORGE IN THE HERKI ORAMAR DISTRICT



HARTOSHI SEDENTARY MOUNTAIN KURDS.



THE ZAB IN ITS QUIETER MOODS.

high plateau, where the houses are underground rabbit burrows, dirty, dark, and airless.

In the summer the nights are very hot in these deep valleys, and the villagers generally go up to their "zomas," or summer quarters, high up on the hills above; a certain number of them, however, have to stay down below to look after the vineyards and irrigate the small terraces of maize, millet, tobacco, rice, etc. These erect high scaffolding in the fields, sometimes 20 feet high, and put their bedding on top. This serves many good purposes, among others security from fever miasmas and prowling animals, forming in addition a good watch-tower, and affording cooler air to sleep in.

Life in these mountain valleys is very primitive. The women do the housework, weave cloth, and make clothes; the children mind the flocks, while a few armed men act as shepherds. The men do the field work and irrigation. These are by no means light duties, as, in order to conserve and make fertile the soil of the numerous small terraces, water must be carried a long way, and often round scarped crags and boulders; this soil also is constantly being washed away by the torrents brought down by the melting snows

These irrigation channels must be very old. I found near Chal, remains of what looked to me like a Roman arched aqueduct.

The ravages of avalanches are also a great concern, as in all mountainous countries these avalanches are very frequent, and sometimes very serious, often damming the streams in the valleys until the water burrows a tunnel through the snow In the gorge of the Great Zab, avalanches crash down 6000 or 7000 feet, sometimes obstructing the stream for hours, by which time a huge volume of water has accumulated, and when this is let loose, one can easily imagine the destruction that is inevitable to the farms on the banks lower down. Bridges that may be in the way are made short work of.

Bridges in the mountains, where they occur at all, are rather fearsome things. The usual variety is a huge tree-trunk or the cantilever, trees being employed for the brackets. When the space to be bridged is too wide to be spanned by this method, the gap between the cantilever is joined by a long wicker hurdle about 3 or 4 feet wide. These are usually very shaky and frail, and swing about while one is crossing them; some can be crossed by mules if the mule does not object; others I have had to cross on my hands and knees with my heart in my mouth. The loads will be carried across, and the mules sent perhaps miles round to find a place where they could get down to the water's edge, swim across, and then a place to land again on the opposite bank.

As all the streams are torrents running in deep gorges, it is very rarely one can get to the water's edge at all, and still more rare to find a stream where both banks afford a footing, so that taking a caravan

of mules across these rivers in the spring is an anxious and slow proceeding. I spent three days in crossing one stream, and many hours at others. At the Lesser Zab, a mule I had bought in Mesopotamia would not face the wicker-track 4 feet wide and 80 yards long, with the torrent some 80 feet below. This was the first mountain-bridge she had encountered. As the villagers said there was no place where animals could be swum across, and I wanted the mule, she had to be got over somehow. Four of us had to carry her on to the wicker part by main force—rather ticklish work on such a narrow and slight platform without parapets! However, when she found her feet did not fall through the wicker, she allowed herself to be pushed slowly across; after a few similar bridges she got quite amenable.

Not so a one-eyed horse which I used to ride myself. I never suspected him of blindness until, crossing a bridge, he shied at the water on one side and fell over the other. I had a great deal of difficulty in salvaging him; he was about twenty minutes in the water before we could get him out, half drowned, and as ill-luck would have it, he carried my saddle-bags, full of all the most precious things, placed there for greater safety—my films, camera, medicines, instruments, etc. These were mostly ruined, and I lost many interesting photographs through this *contretemps*.

With the exception of one or two beaten tracks, the roads in these mountains, especially the Herki Oramar district, are rather of the "fly on the window" variety. There are no direct roads anywhere, and only very bad foot-tracks from village to village. This is not surprising in a country where many of the inhabitants have never been out of their own villages, and a man who has been into the next valley is looked upon as an adventurous traveller. One consequence is that there is great difficulty in obtaining trustworthy guides for any distance.

Mules to a limited extent are used, but there are very few, and as there is very little pasture for them, the few animals that belong to the region are sent up to winter in the plains of Gavver. It is wonderful how clever these mules are in climbing the rocks and crossing the talus and detritus, which abound everywhere. However, in the case of some village on ledges high up on the scarped slopes of gorges, the trails are too difficult for any animal, and the villagers have to climb up and down. Sometimes one finds a mule and oxen even there, and on inquiry I learned that they had been carried up to the present elevation while young on a man's back.

Some of the trails cut out round buttresses of rock in the gorges are very dangerous, and the mules have to be carefully man-handled over the bad places. In a gorge of the Bohtan, south of Shattakh, I saw three mules of my caravan knocked, one after the other, off their legs by a projecting rock and tumbled into the Bohtan and washed down to

the Persian gulf, without a chance of saving the unfortunate animals or their loads.

There are one or two caravan routes through other parts of the mountains, which thousands of years of traffic have made more passable, while in places one finds many relics of stone causeways and bridges, legacies of the ancient civilizations that have held these districts—Assyrian, Persian, Greek, and Roman. A fine example of such a route runs from Bitlis across the mountains and the Keser Su valley to Sairt, and so on down the Tigris to Jezire and the plains. This, therefore, I believe, follows the route taken by Xenophon. The Greeks were bad geographers at the best of times, and I think Xenophon, in the excitement of his retreat, must have neglected the geographical part of his diary in his anxiety for his people; anyhow, I have tried to trace his route from the scanty data he gives, and found it impossible to make them agree entirely with the lay of the land as it is to-day. However, I have little doubt that it was the Bohtan Su, just above Til, that he forded, and not the Tigris. A lot of labour must have been expended in making a causeway up the Great Zab valley, and in the Bahdinan country are numerous traces of fine causeways, bridges, and cities.

Few countries have so many ruins of ancient fortresses and citadels as Kurdistan. It is a paradise for the archæologist; abounding in crags and giddy pinnacles "pointing like daggers into the heavens," as one Assyrian writer describes them. On the top of most of them one finds traces of ruins of some sort or other—Kurd, Assyrian, Urartian, or even prehistoric. In many places one finds huge cyclopean stones, looking now like ordinary rocks, but situated in such a manner as to show they were placed there by man, or giants, as the natives declare.

There are many similar ruins found all over the grassy valleys in Norduz and just south of the Arnost range, probably towers or block-houses. The farthest south I have found these was in the village of Sat, in the Herki Oramar district, while the biggest is on the top of one of the high crags of Judi D. This mountain, by the way, and Finuk are veritable museums of archæology, containing, as they do, every variety of architecture, from the cave of the Troglodites to the mud hut of the Kurd, with Assyrian, Persian, Greek, Roman, Arab, and Seljuk intervening.

Many Assyrian ruins, rock-carving, bas-reliefs, and inscriptions are to be found on the southern crags and valleys of Judi D. These are all ascribed by the natives to Sennacherib, but this is probably because he was the only king of Babylon mentioned in the Bible. On the top of the mountain are four large bas-relief stelæ with cuneiform inscriptions, one facing each of the cardinal points of the compass. They are all much worn, and in extremely awkward places to get at or photograph.

Jezire and Mukus were Roman outpost provinces at the time of

Diocletian, and it is interesting, while travelling, to pick out traces of their occupation in roads, forts, etc. In the picturesque valley of Khizan is what I believe to be a Roman fortress, in a wonderful state of preservation; this may very possibly have been the capital of the Roman province of Moxene, lying between the buffer states of Armenia and Mesopotamia. The ruin is a fortress some 250 yards square; walls originally about 25 feet high and 15 or 20 feet thick; semicircular or square towers at intervals of about 60 feet, and rising higher than the curtains. Some other ruins of Seljuk date lie scattered around and about, and Kurds have made their hovels among the remains.

I have already mentioned a few of the difficulties of travelling in these mountainous districts. The transport employed in the high plateau is horse, while the natives often employ oxen. In the mountains, mules and porters only are possible, and in the Mesopotamian plains mules and camels. If one makes a journey including parts of all three zones, mules are the best, but, unfortunately for my purpose, mules are not obtainable in Van and the high plateau, so I always had to set out with horses, and experienced innumerable difficulties with them in the mountains before I could exchange them for mules.

One of the principal difficulties is the feeding of the animals. There is no fodder in these mountain villages, and, except for a very short time in the spring, there is no grass. Horses, when they have once started eating the spring grass, will look at nothing else for about three weeks, and this weakens them enormously, making them unfit for work, and, for lack of other fodder, one is generally obliged to give it to them in these steep valleys, just when they have the most work to do.

Travelling over high peaks and low valleys, one is alternately in spring and autumn, and it is no exaggeration to say that you can camp in the morning where people are sowing the corn, and in the evening where they are reaping it. All this is very trying for a horse's or mule's digestion, and they soon give out.

Travelling in these mountains south of the Arnost range is almost impossible except for a few months of the year. The snow makes the passes impracticable for six months, and by the time these become passable the heat makes the valleys unbearable. The Herki Oramar district is impossible to reach from the west before June, and even then there is a large quantity of snow on all the passes; but by that time it has packed and mules can cross it.

The Arnost range is a barrier which even in its most accessible passes is practically impossible to cross with mules before April, and then one has considerable difficulty and risks, and may have to use felt mats to enable the mules to pass over the more dangerous snow; this naturally entails considerable hazard and occupies much time. Bitlis pass is open about this time, but the approaches to it from the north

are closed. The rivers south of the range are then all in flood, and the innumerable small streams are roaring torrents; most of the bridges (always temporary structures) are washed away, and while the small streams entail endless trouble and difficulty in crossing, the larger ones are often impossible to a caravan, unless large sums are to be expended in constructing new bridges.

Guides and escorts are another serious consideration; the former are usually difficult to find, and seldom know the names of any villages or places away from their own. One available method is to get handed along as the guest of one Kurd Agha to the next, and these send some of their retainers with you; but this is rather an expensive way, as it usually involves much baksheesh, and often they will not take you the way you wish to go on account of blood-feuds or other private reasons.

There are certain beaten tracks for caravans between Eiseroum, Bitlis, Sairt, Diabekir, Mosul, Baghdad, etc., when a couple of gendarmes is all that is required. I was referring more to mountainous tracks away from the beaten ones, where things are different, and where travel is attended with a certain amount of risk, and many more discomforts. The crossing of rivers is one of the worst difficulties. "Keleks" or rafts of brushwood on inflated skins is the method usually employed, though here and there on the bigger and quieter rivers a ferry-boat of a very antediluvian pattern is found; these are difficult for horses to embark into, and are always carried a long way downstream, and have to be pulled up again. One of the principal difficulties is the impossibility of obtaining any reliable information about the country in front of the traveller to enable him to make his plans. The natives will always say there are corn and food to be found everywhere; as often as not this is true, and it is annoying to arrive after a hard day's march in a district where there is no food for the horses, or some other essential commodity is lacking, or to find that a promised bridge, over an otherwise unfordable river, does not exist. Yet this is frequently one's fate.

As one might expect in a mountainous country, the scenery is sometimes superb: snow-capped summits and jagged rocky crags with deep gorges and cañons below, while, on the Persian frontier ranges, forest belts intervene between the snows and the cañons; the villages, placed picturesquely like swallows' nests against the hillsides, with their narrow terraces of cultivation, their vineyards and fruit trees, and the ever-present poplar grove to supply timber for house-building, bridges, and every other need.

As I have already mentioned, with the exception of a few valleys in the mountains which are entirely Assyrian and "Asshiret," the Christian villages are dotted here and there indiscriminately among the Kurds. In Turkey the law forbids people to carry arms, but this is only enforced in the case of Christians, who are rigidly forbidden to own or carry any sort of arms. No Kurd ever goes without a khanja,

and a gun and cartridges, if he has one. This leaves the Christians at the mercy of the Kurds. The mountain Kurds are in small tribes under petty aghas, and these usually undertake to protect the Christian villages in their neighbourhood. The Assyrians pay them tribute, usually in money and kind and free labour.

In the high plateau the tribes are much bigger and more powerful, and there is less petty warfare. The nomads also are usually in larger tribes, which makes them feared by the petty mountain aghas. The real power in the mountains, however, is the sheikhs, the religious chiefs. These, Arabs by origin, generally live at some holy shrine, often the tomb of their original ancestor, and the local Kurds come to them for counsel and advice, spiritual and otherwise. From the gifts they have received they have become rich, own lands and villages, and so many armed servants that they have grown more powerful than any of the tribal aghas, with the exception of the nomads, and are veritable despots.

The Sheikh of Shemsdinan has 1500 men-at-arms. The principal ones are the Sheikhs of Shemsdinan, Khizan, Bamarni, Barzan, Tello, and Budgil. These sheikhs do not use their power and influence entirely for religious purposes, and some of them are little less than brigands; but their power over the petty aghas is great, and they can usually force them to do their will. Jelal-a-din, the Sheikh of Khizan, took 30,000 Kurds to pillage round Bayazid during the Russo-Turkish war. Obeidulla, the grandfather of the present Sheikh of Shemsdinan, invaded Urmi in Persia with 40,000 Kurds. They are very jealous of each other, and are great intriguers. Portions of the Heriki Oramar district come under the influence of Shemsdinan, Barzan, and Bamarni, and this does not add to its tranquillity.

Some 60 miles south of the Arnost range is another spur or chain, a very massive one, but broken up, as I explained above, in the angle, as it were, where the mountains turn south-east down the Persian frontier. This chain is formed by such masses as Harakhol, Marhan, Ghara, Jelu, Seri-i-Sati and Bash-i-Ruan Ds, and then along the Persian frontier, Kandil, Ako, etc. Both the Zabs penetrate the range through natural gorges. There are many big spurs detached south from these mountains, and the valleys between these make some remarkably deep gorges, here and there the rocky spurs will curve round, horseshoe fashion, giving a little more space in the valley, and such places are seized on by the natives for terracing for the purpose of cultivation. These southern gorges drain into a long crack or furrow, which runs west to east. Midiat, Jezire, Zakko, Amadia, and Shemsdinan are all in the furrow, and the Tigris, Khabur, Great Zab, and Shemsdinan rivers all force their way into it from the north, and run along it for some distance before forcing their way south through the next range.

The most imposing of all the many fine chains of rocks in this



ORAMAR VILLAGE AND BARREN SPURS FROM NORTH



CHALL AND MOUNTAINS OF TIARI FROM SOUTH.



BATOAN NOMAD KURDS.



ENIRCO-AGHA SHEKAK, HIGH PLATEAU KURDS.

region, and perhaps in all Kurdistan, are the so-called Sat D. and Jelu D. In Kurdistan it is rare to find a native name for a whole range of mountains; each valley has a local name for the peaks and passes above it, but there is seldom a universally accepted name for the mass.

The Jelu chain starts from the Great Zab, runs in a horseshoe curve east; the Sat D. here joins it, running east-south-east from the heel of the horseshoe. Both these masses are similar in construction. Limestone strata tilted north, with the north slopes grassy and easy, except where the high crags protrude at the tops. On the south they fall from a height of 12,000 feet abruptly to the elevation below of 2000 feet, and often this drop is all in a distance of less than a mile. The numerous spurs which run south from the main mass to the Shemsdinan Su are of an average height of 8000 feet, and often only 4 miles from the summit of one to the other, but these 4 miles include a valley 5000 feet deep.

These spurs have similar subsidiary spurs of their own, the whole forming a most tangled system of rocks and crags, with numerous springs and mountain torrents, and cascades gushing down deep gorges. Curiously enough, the most easily cultivable places are found close under the most precipitous rocks, while the slopes, where neither bare rock nor cultivated, are covered with "scrub" oak forest.

This district is drained by the Shemsdinan Su, which, rising in the frontier hills of Mergaver, flows west through the wooded slopes of the rich Shemsdinan district, celebrated for its tobacco, which is grown by the sheikh and sold in Persia at a huge profit, estimated to bring him in £10,000 a year. The river forces its way through a fine gorge, below the majestic snow-capped peak of Guramiz, on the Bash i Ruan range, somewhat resembling the Matterhorn; it is here joined by the Khumara Su from the north. Its valley then opens out to an undulating basin, with wooded slopes and several villages of Kurds, with here and there rough stony detritus and limestone outcrops. On the north the river is joined by the torrents from the Sat D. while the various spurs from this mountain form huge crags frowning down on the bed.

On the south is a long plateau-like ridge with stepped escarped slopes, the strata in this case being reversed and sloping south gently towards the Mosul plain. The surface of this plateau is extremely rough, being bare limestone, scoured like a rasp. This range runs from Guramiz to the Zab, and is practically desolate on top. Two valleys or clefts penetrate its northern side, and in these are a few villages of Girdi Kurds, dependants of the Sheikh of Barzan, who lives on the south side of the ranges, near Zibar on the Zab. The Shemsdinan valley is joined later by the Oramar Su, a large affluent draining the north slopes of Sat and south slopes of Jelu D. The river is then called the Rudbar-i-shin, and then passes through a deep cañon called

Tang-y-belinda, to join the Zab above Zibar. Fair trails follow this valley from Shemsdinan to Zibar, but they have to ascend to a considerable altitude to avoid the Tang-y-belinda behind.

On account of the scarped and tangled nature of the country, the multitude of valleys and gorges, and their depth, it is very difficult and tedious getting from place to place; a point which may only be two miles away, may as likely as not take a day's journey to reach. The natives make very short marches in a day in consequence. On leaving Neri, the village of the Sheikh of Shemsdinan, and going west, one passes along rough rocky slopes high above the Shemsdinan Su, and down to one of its affluents, the Khumara Su, a stream of great pace and volume and fine blue colour. In this Khumara valley are several Kurd villages nestling on the slopes. A long climb of 3500 feet brings one to the crest of the first or easterly spur of the Ser-i-Sati. Here the limestone strata are tilted up to the perpendicular, projecting in row on row of giant saw-teeth, 15 to 20 feet high, and difficult to cross. One descends from here a steep 3000 feet in 2 miles over rocks, shale, and scrub to the valley of Beitkar, which is in a horseshoe basin some 1½ miles wide under precipices of sheer rock, 3000 to 6000 feet high.

There are three villages in the basin, but they are, more properly speaking, scattered farms on arable ground. These belong to the Girdi Kurds, whose chief Zulferkan Bey lives at Zerin to the south. This village of Zerin is half Nestorian and half Jew. The Beitkar basin is most picturesque, though its features are so huge and close together that no photo can take them in or do them justice. The Kurds here are lazy and do not make the most of their ground; but the fruit and walnut trees are very fine.

A track from the Beitkar basin follows the stream through a gorge down to the other Girdi villages in the Shemsdinan Su valley. There are altogether some fifty villages of Girdi and Heriki Kurds in this district. There is very little pasture in this basin other than what is cultivated on the terraces, and so, such mules as they have, are sent up to Gavver to winter.

The cemeteries of these Kurds have many original features. They place semi-cylindrical wooden covers over the graves to keep the departed dry; a couple of sticks stuck into the ground at head and foot have a string attached, and to this is suspended woollen tassels of various colours, handfuls of corn, millet, etc., being sown round the grave. In the adjoining valley of Heriki there are some fine tombstones, for here the bodies of the chiefs of the big nomad Heriki tribe are brought for burial.

Another knife-like rocky spur of the Sat D, 8000 feet high, separates the Beitkar basin from the Heriki valley. This, a narrow valley, perhaps 4 miles long, contains some two hundred rich farms or terraced gardens, well-built stone houses, and the richest cultivation

I have seen in these parts, including rice, tobacco, nuts, corn, apples, apricots, vines, and millet, while its natural beauty would be hard to beat. Huge alpine crags and snowy slopes, foaming torrents running over immense boulders and shaded by verdant walnuts, poplars and willows. Hawthorn, laburnum, mulberry, and various fruit trees separate the terraces of luxuriant grasses—clover and corn, roses, bluebells, buttercups, daisies, and many other varieties of wild flowers everywhere; the vines are trained on the trees pergola fashion. This is the Heriki valley.

Most of the shaley slopes of the mountains here are covered with a sort of large asparagus-like fern of very brilliant green tint in spring, which greatly enhances the beauty of the scenery. The natives cut, dry, and stack this for winter fodder for their flocks, leaving only an odd plant here and there for seeding. This beautiful valley has the doubtful honour of producing the nomad tribe of Heriki, popularly supposed to be the biggest thieves, taken all round, in a country which contains quite a lot of past masters in that noble art. Many years ago, four brothers set out from this valley and founded the nomad sect. The descendants of their relatives still occupy the valley, and though sedentary, quite recognise the kinship of the nomads. We had the luck to meet these nomads in this part of their trek from the plains to their summer quarters. They cross the Zab at Zibar, where they have to build a bridge each year. This takes them some time, and they have to behave themselves there, so as to keep on good terms with the local Kurds of the Sheikh of Barzan, who could otherwise prevent their passage. They then follow up the high track over the Tang-i-belinda, and east along the trails in the Shemsdinan Su valley—a long, straggling string of laden travellers, mules, horses, and cattle. The sheep in flocks of three hundred to four hundred graze along with a few armed guardians high up on the mountain slopes. They split up after passing the junction of the Oramar Su, some going up the Sat valley, others the Heriki and Beitkar valleys, slowly and by short stages winding up the high passes to the "Yailas" on the north of the Sat D.

They travel in a very leisurely go-as-you-please, and straggling fashion, rather like a lot of ants, two or three families apparently travelling together, their impedimenta of sacks of corn, tents, rugs, felt mats, clothes, etc., loaded on to horses and cattle, while here and there a sick sheep or calf will be tied on to the top of a load. The women plod along in rags, carrying on their backs an odd assortment of cradles, pots, pipes, trays, butter-making skins, gourds, samovars, gear for weaving and spinning; this always in addition to the inevitable baby. Here and there a bit of colour is afforded by the brightly painted wooden box with an agha's best clothes and his teacups. Every one walks except the swells, all the horses and cattle being employed for the loads. The men armed to the teeth, with all their cartridges on

them, act as escort, and swagger about among the villages, chatting with the villagers. One or two accompany the boys with the numerous flocks of sheep on the upper slopes.

It is an anxious time for every one, this passage of the nomads. The villagers will remain in their houses with doors bolted. The men armed and ready, hang round the houses, and at strategic points; every one is nervous and suspicious, and a lot of promiscuous and intermittent firing occurs. We met one flock in a picturesque spot on the top of a crest, and wishing to take a photo of them and their escort, I asked the shepherd to stop a minute on the rock he was clambering over. He bolted off down that hill like a hare, shouting for help, unslinging and loading his rifle, and did not stop till he got cover some 400 feet below, and prepared to fire at us. Herds of sheep look sick and weak, and many die. Flocks of eagles and vultures follow the trek. The nomads do not unpack their loads at night, but bivouac beside them, rolling themselves up in the long felt gechis or mats.

Climbing on the slopes of the Sat is not very difficult to a mountaineer, but is extremely tedious and fatiguing. At the time we passed there was too much snow at the top to make the highest peaks accessible without ice-axes and ropes, and we were reluctantly compelled to abandon our intention of climbing the highest points, of which there are some six, but satisfied ourselves with some of the lower ones where the snow did not offer such difficulties. From these some magnificent wild mountainous scenery can be seen; rows of teeth-like crags all round, with the thin jagged spurs shooting south to the Shemsdinan Su valley; the huge Bash-i-Ruan range to the east, and the rocky plateau between it and the Zab acting as a middle distance to the far off Mesopotamian plain. In a clear day, I am told, Mosul is visible from these peaks; unfortunately, we never had a clear-enough day.

The Deh and Sat valleys or basins come next after the Heriki one, they are more open, higher, and less charming. The Sat is tree-shaped, and badly cultivated, its height is 5400 feet, while that of Heriki is only 4250; the crags tower some 6000 feet above it. The basin is covered with stunted oak, scrub, and vineyards are cultivated extensively on the higher slopes of the subsidiary spurs. There are Chaldean Assyrians and Heriki Kurds at Sat. Two summer passes lead through defiles high up in the Sat D. to Gavver, but they are very rough and difficult: the nomads, however, use them. At Sat is the remains of an Uratian or giant's fort of Cyclopean stones. The Deh Su joins the Sat Su, which flows west to join the Oramar Su. Its valley is thickly wooded, stony and rough, with numerous deep ravines on the north, penetrating into the mass of the Sat D. Another big knife-edge span, 8000 feet high, separates the Sat valley from the Oramar valley.

Oramar is one of the most picturesquely placed spots I have ever seen; on a double horseshoe-shaped ledge of rock, 5200 feet high, crags

some 14,000 feet high, with a deep cañon some 2000 feet sheer down below, it is a veritable swallows' nest. The cultivation of the village is on elaborately built-up terraces, often only one yard wide, the hill slopes being so steep. There is an abundance of good water from springs and melting snows, and the soil is very rich, producing the finest grapes in that part of the world—grapes without stones and fully 2 inches long.

These terraces are very ancient and were probably first made by the Assyrians, as an ancient and much respected Assyrian Ziaret (sanctuary) and church of Mari Mamo lies on the slopes above the village. The Oramar Kurds are very proud of this Ziaret and keep a tame Nestorian priest in charge of it. Its history is quaint. Native tradition says, Mamo, a saintly man, was persecuted at Cæsarea by Alexander the Great, thrown three times into the fiery furnace, was released as incombustible, came to Oramar, collected all the snakes in the land, and placed them under a large stone in a hole. This is the Ziaret or sanctuary. The guardianship of this stone is hereditary, and if the right guardian is dispossessed the snakes will get out, and the Ziaret will lose its power for healing snake and dog-bites, and stings of scorpions, fleas, etc., a useful shrine in this country, and I was greatly inclined to try its efficiency during the night I spent at Oramar.

There are many ibex and bear to be found on the crags about Oramar. At a height of 5250 feet, the Oramar ledge has not the luxuriant vegetation of the Heriki valley, but it is the richest, best-arranged, and best-built Kurd village I have come across in the mountains. There are thirteen villages of these Oramarli Kurds around this valley. The chief is Suto Agha, who lives at Nerva on the opposite side of the gorge. At Oramar, Havzula Agha and Mohamed Aga are two fine specimens of the Mountain Kurds, well-mannered, hospitable, and quite aristocratic in their way. The Oramarli are, I am sorry to say, terrible brigands and sheep-stealers, and are always at war with their neighbours and stirring up strife. They are so secure from attack in their mountain fastnesses that they can defy the Turkish Government.

Down in the plains between the Tigris and the Persian frontier is the important town of Kirkuk—an old town, built by the Assyrians on a huge tel or artificial mound of earth 100 feet high and some half-mile square, which must have necessitated some labour. The later Assyrians called this town Kala de beit Sluk, which means the "castle of the house of the selucids." The Turks have contracted this to Kirkuk. A little north at Nineveh one sees the tomb of Jonah; here at Kirkuk one is shown the tombs of Shadrach, Meshach, and Abed-nego. It is a veritable oasis in the desert, with palm-trees and fruit-gardens. These are the first palms one meets coming from the north.

Going east from Kirkuk, one crosses an undulating plain, first of

igneous rock, and later gravel, and then grassy downlands, with later the inevitable limestone, and then the saw-tooth ridges reappear, this time running north-west and south-east. Here, however, they are smaller and more rounded to commence with, with wide grassy valleys between them, getting bigger and closer together as one gets further north-east.

Sulimanie is an important Kurdish town in one of these grassy valleys. The country between Kirkuk and Sûlimanie is the region of the dreaded Hamawand Kurds, a nomad tribe of some 2000 rifles, whose boast is that they care for nothing except mares, guns, and raiding. They are a wild lot, and the terror of all the other Kurds and the surrounding country. Some years ago the Turkish Government tried to punish them, and, after much manœuvring of troops, they captured a few and exiled them to Tripoli, in Barbary. One of their chiefs told me with pride that, three weeks after these had arrived there, they escaped, and walked all the way back to the Persian frontier. They affect a semi-Arab dress, and, like the Arabs, ride mares and sell the horses. In the high plateaus the Kurds only ride stallions; mares are considered unworthy to ride.

The Hamawand make travelling a risky business in this country. We were, however, escorted through by one of their chiefs with his men. They were most boastful, and tried to impress us with their might and power; but they are really not much better than armed gipsies. Their tents are filthy, and they have very little of the commodities which pass for riches in that country.

Sulimanie is an old town of Persian type which during its history seems to have changed hands from Turk to Persian pretty frequently.

It has a fine bazaar, and is the centre of trade among the frontier Kurds when the Hamawand permit. It is celebrated in the district for its gunsmiths, whose imitation Martini rifles are in great request among the local Kurds. North-east of Sulimanie is a larger limestone ridge of 5000 feet high. On the other side of this is the Shar bazaar, Kara Cholan, and Sewell basin, an undulating open, gravelly basin, broken up by many large nullahs covered with grass and scrub, with large stone outcrops in the centre. This basin is drained by the Karacholan Su flowing north-west to the Lesser Zab. It is a broad, clear stream, winding over a shingle bed, with trees and patches of grass and cultivation on its banks, and rather gives me the impression of a river in a highland "strath." This basin should be rich if properly cultivated, and there are ample signs that at some previous period it was so, as ruins of well-built cities, large masonry bridges, and castles can be seen on every hand. It has rather the shape of a horseshoe, the north-east end of the toe or shoe being the Persian frontier.

A large affluent, the Sewell joins the Karacholan in the north of the basin. The Sewell valley is more hilly and wooded than the others and

resembles a huge nullah. There were a good many villages in this basin; Kurds, sedentary and agricultural for the most part. The chief tribes are the Sewell, Alan, Shar Bazar, Mawat, Seron Mirau, and Shaenik. The Persian influence shows itself in these Kurds in their houses, clothes, tents, speech and everything. The felt, sleeveless waistcoat of the Turkish Kurd gives place to a long thick, quilted tunic with sash round the waist, baggy trousers, and huge turbans; the size and colour of the sash, indicating the rank and opulence of the wearer.

The Kurds on this part of the Persian frontier speak a different Kurdish to the Turkish ones. Their language is called Kurmanji, and curiously enough, contains some few Latin words; for example, genu for knee. They are a finer, more manly looking lot, and most hospitable. They have the reputation of being brave and warlike. The country here being more open, and communication easier, the tribes are larger, and I got the impression that there was not much inter-tribal fighting. There are a few small tribes of nomads who live about in this basin with their flocks and tents, but none of much importance.

North of the horseshoe Sewell basin, the Bana Su, a large river, from the east, joins the lesser Zab near Alot. These two ridges here run in deep cañons through high ranges of mountains, the altitude of the rivers being some 2300 feet, while the hill-tops are 8000 feet. In reality the ridges of hills still retain their rounded undulating formations, but the melting snows and large rivers have worn deep channels in the valleys. Then the lesser Zab, forcing its way from a basin 5000 feet above sea-level through a range of 8000 feet, down to a plain of 1000 feet, has, with its numerous small tributaries, scored out deep channels, and generally tangled up the country. From the hills above one sees a vista of several ranges of wooded undulating hills, the deep gorges and cañons in the valleys below being quite invisible and unsuspected.

After the Bana Su joins the lesser Zab, it forces its way through the biggest of the parallel ranges of mountains. I will call this the Kandil range; this runs up to the Bash-i-Ruan D., getting higher as it goes north, many fine limestone crags with marble deposits appearing on its summit, assuming the saw-teeth formation. The upper and east slopes of this range are covered with fine oak forest. The west slopes are precipitous crags, while on the east lie the rich open plains of Lahijan and Pesveh, with the lesser Zab, here quite a docile stream, winding about and irrigating the fields. This is the habitat of the large powerful semi-nomad tribe of Bilbass Kurds, with its numerous sects.

Outside Kala Pesveh in the Lahijan plain, is a Baal pillar of some interest, a monolith of granite standing in a little enclosure of its own, with offering before it. This must be very ancient, more so even than the "Tel" on which the "Kala" is built. At the northern end of the Lahijan valley is an imperceptible watershed between the lesser Zab which goes to the Persian Gulf and the Ushnu plain which drains to

the Urmi lake. A big spur from the main ridge then cuts across east to Lake Urmi; north of this spur the Mergavver, Tergavver, and Baradost valleys continue the geological furrow of the Karacholan and Lahijan valleys up towards the Russian frontier.

The PRESIDENT (before the paper): Captain Bertram Dickson, who has kindly consented to lecture here to-night on the subject of Kurdistan, has had interesting experiences in many parts of the world. He has seen service both in South Africa and in Somaliland. After leaving Somaliland he went to British East Africa, where he was employed on certain important surveys, which he described in the pages of our *Journal*. He was next employed under Sir Thomas Holdich in the Argentine-Chile boundary Commission, visiting South America on two occasions with Sir Thomas Holdich. After that he was Military Consul in Asia Minor, where he had the opportunity of travelling in Kurdistan, and it is his experiences in that country which he will describe to us to-night.

Colonel Sir HENRY TROTTER: I had the honour of being the first Military Consul appointed to Asia Minor. It was in 1878, subsequent to the Turko-Russian war. My first acquaintance with the Kurds of the Vau district was during that war. The Turkish regular army was assisted by several thousand Kurdish irregulars. Shortly before I joined the army the Russians had captured by surprise the frontier town of Bayazid, but the Kurds massed together in very large numbers, and the Russians, having exhausted their provisions, were obliged to capitulate and evacuate the town. The leading files had scarcely got outside the gates before the Kurds fell on them and commenced a massacre. The Russians hastily re-entered the citadel, and were rescued shortly afterwards by a fresh Russian army promptly despatched to their assistance. These bloodthirsty Kurds were dispersed to their homes, but many others remained with the army, and with some of their chiefs I became very intimate. Two years later on, when Consul at Erzeroum, I came across one of them under very different circumstances. I had to pay a visit in the interior to one of the worst persecutors of the Armenians of the surrounding district. I was duly prepared to give him a severe lecture on his wicked ways, but when ushered into his presence we instantly recognized each other as old friends, and rushed into each other's arms! My lecture took a different form, but the result was ultimately satisfactory, and the Christian rayahs benefited therefrom.

It seems not unnatural that the inaccessible mountain fastnesses that the lecturer has described to-night should give refuge—as it does in certain districts—not only to Kurds, but also to Nestorian Christians, some of whom live in a state of semi-independence of the Turkish authorities, who can but rarely enter the country to collect the taxes, most of which are paid to their own hereditary chiefs.

At Midyad, in the south-west corner of the map, I spent some days many years ago among a very interesting people—the Jacobites—a brave, tall, and handsome race, physically superior, I think, to any other that I have come across in Asia Minor. They live in a rugged, hilly, stony, limestone district, about 3000 feet above sea-level; were generally armed and able to hold their own against their more numerous Kurdish neighbours, with whom, however, they would sometimes combine, like the Kurds and Nestorians in Hekkiara, to assist the Turkish authorities. These Jacobites numbered 12,000 and speak a Syriac dialect, differing considerably, however, from that of the Nestorians.

Colonel MAUNSELL: I think Captain Dickson is the first person who has explored the Sati Dagh, a difficult country with splendid mountain scenery, as exemplified by the numerous photographs we have seen. The three zones coloured on the map are

really important features. They represent different climates and different productive areas. The lower one is really part of the Mesopotamian plain; while the centre zone is the most productive, the country being well watered, having parallel limestone ridges, with fertile valleys between. In the highest zone are grassy hills which are pastured by the flocks of the Kurds. These flocks produce wool, and the sheep are marched down to the coast at Alexandretta; some reaching Malta and Egypt.

The PRESIDENT: In many of the lectures given here, I have noticed that explorers have thought it the best way to describe the country visited by giving a mile by mile and day by day description of their travels, without attempting to draw any general conclusions or wide generalizations, leaving that all to the reader. Now, it is obvious that the explorer himself ought to endeavour to focus the attention of his hearers on all the prominent features. I think Captain Dickson has set an excellent example in this respect, which you will probably appreciate even more when you come to read his lecture in our *Journal*. He has dealt with many questions in broad outline, and any one who wishes to travel in Kurdistan could learn a great deal of great value from this lecture. I am sure you will wish me in your name to congratulate Captain Dickson on his lecture, and to give your hearty thanks to him.

THE SAND-DUNES OF THE LIBYAN DESERT.*

THEIR ORIGIN, FORM, AND RATE OF MOVEMENT, CONSIDERED IN RELATION TO THE GEOLOGICAL AND METEOROLOGICAL CONDITIONS OF THE REGION.

By H. J. LLEWELLYN BEADNELL, F.G.S., F.R.G.S., Assoc. Inst. M.M., formerly of the Geological Survey of Egypt.

THE valuable series of articles on kumatology written by Dr. Vaughan Cornish and published in the *Geographical Journal* is well known to students of physiography. In one of these papers the dunes bordering the Nile delta are discussed, and recently, in an article formulating suggestions for the observation of sand-dunes by travellers in North Africa, Dr. Cornish has briefly referred to those remarkable elongated dune-massifs of the deserts to the west of the Nile.

The object of the present paper is to give a preliminary account of the geographical and economical aspects of the great sand accumulations of the Libyan desert, especially in relation to the geological and meteorological conditions which exist in this region. The subject is of far wider interest than might at first sight be supposed, as the welfare of thousands of souls in the oases of the Great Sahara and other deserts is intimately connected with the rate of movement and mode of accumulation of wind-borne sand. In some localities extensive and prosperous settlements have been overwhelmed and blotted out of existence, while in others the sand and dust-laden winds have been of positive benefit to the inhabitants. In the south part of the oasis of Kharga, for instance, broad terraces of cultivable loam have been gradually built up in the neighbourhood of the wells, the deposition of the wind-borne material being encouraged on account of its valuable fertilizing properties. The

* Research Department, January 20, 1910.

study of dunes is also of the first importance to those engaged in the reclamation and colonization of desert tracts. Instances might be mentioned, moreover, for example, in the maintenance of desert railways, where endless trouble and expense have been incurred which might have been largely if not entirely obviated, had those in charge of the surveying and laying out of the routes recognized the fact that desert dunes are not anchored or stationary hills of sand, but mobile masses advancing at a very appreciable rate in a definite direction.

In the course of nine years' survey and exploration work in the Egyptian deserts, as a member of the Geological Survey of Egypt, I have skirted or traversed many of the great sand-belts and dune-massifs lying to the west of the Nile. These traverses have enabled me to further our knowledge (as shown on the maps of the Rohlfs Expedition of 1873–74) of the geographical distribution in this region of the great accumulations of sand, and have afforded opportunities of observing the relations of the latter, firstly, to the geology, and, secondly, to the configuration of the country.

During the past three years, moreover, I have resided more or less continuously in the oasis of Kharga, one of the great depressions in the Libyan desert tableland, and have devoted such time as I could spare to a more detailed study of individual dunes, especially as regards their rate of movement, a subject with which, owing to the exigencies of ordinary desert travel, it is difficult for passing travellers to deal.

(*a*) *Geographical Distribution.* — The most important of the sand accumulations of the Libyan desert are shown on the accompanying plan (Fig. 1). It will be noticed that the sand occurs in two distinct manners; firstly, as narrow, elongated, well-defined belts, and, secondly, as irregular accumulations of varying form and dimensions. Not only the belts themselves, but the individual lines of dunes composing or surmounting both the sand-belts and the irregular sand-massifs, preserve a remarkable parallelism of disposition, everywhere lying approximately north north-west and south-south-east, parallel to the direction of the prevailing winds.

To the west of the 27th meridian east of Greenwich, practically the entire country south of the Miocene escarpment—passing to the north of Siwa and Jerabub—is buried under a great sea of sand. On the eastern side the country is far more open, the sand being confined to isolated belts and comparatively small irregular dune-massifs. The most remarkable of the former is that known as the Abu Moharik, which commences in lat. 29° 45′ N., at Arûs el Buqar (some 50 kilometres south-west of the Mogara swamp), in the low country to the south of the great east and west Miocene escarpment. From Arûs el Buqar the Abu Moharik sand-belt runs in an almost straight and unbroken line across the Libyan tableland into the depression of Kharga, through which it continues into the desert to the south. The average breadth of this

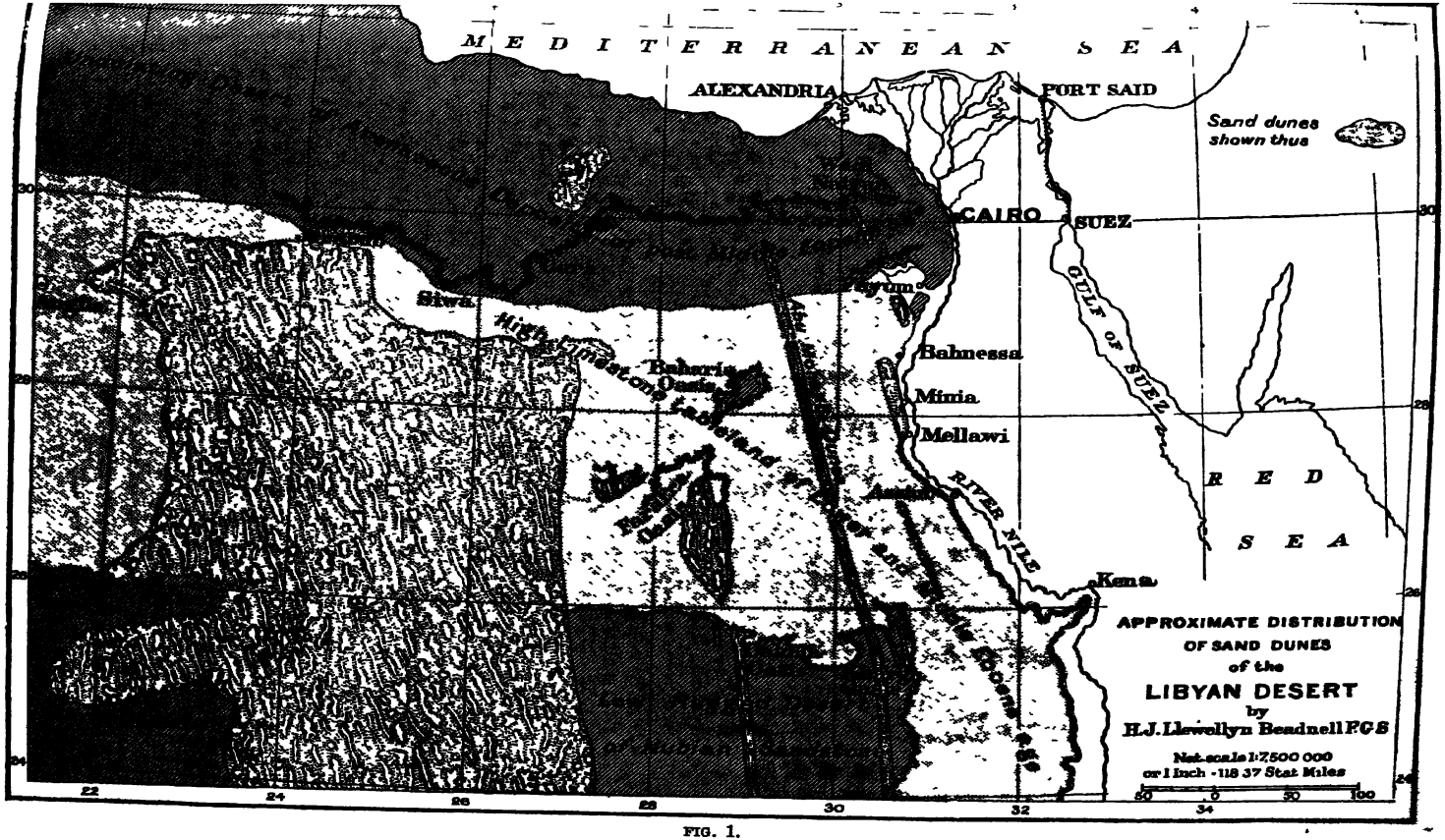

MEDITERRANEAN SEA
ALEXANDRIA
PORT SAID
Sand dunes shown thus
CAIRO
SUEZ
GULF OF SUEZ
Bahnessa
Minia
Mellawi
RED SEA
RIVER NILE
Kena
APPROXIMATE DISTRIBUTION OF SAND DUNES of the
LIBYAN DESERT
by
H.J. Llewellyn Beadnell F.G.S
Net scale 1:7500 000
or 1 Inch = 118 37 Stat Miles
50 0 50 100
22
24
26
28
30
32
34

FIG. 1.

line of dunes is only some 6 or 7 kilometres, whereas its length cannot be less than 650. Another remarkable sand-belt is the Ghart el Khanashât, to the north of the Fayûm. Large irregular accumulations of dunes are found in the depressions of Gharak and Mouailla to the south of the Fayûm, in the oasis-depression of Farafra, and encroaching on the cultivated lands of the Nile valley between Bahnessa and Mellawi.

(*b*) *Origin.*—It appears to have been generally assumed that the great sand accumulations of the Libyan desert have originated in the denudation of the Nubian Sandstone, but I have never myself met with evidence in support of such a view. Silica is the main constituent of the sand, and it is evident, therefore, that the material of the dunes is derived from the weathering of arenaceous beds. On the accompanying plan I have shown in broad outline the geological deposits forming the surface of the Libyan desert, from which it will be seen that the central part, between lats. 25° 30′ and 29° 30′ N., consists of an elevated limestone tableland of Lower and Middle Eocene age. To the south lies a rugged, and generally lower, desert of Nubian Sandstone; while to the north, stretching to the Mediterranean sea, is found an undulating country of post-Middle Eocene age, very largely consisting of arenaceous deposits.

Now, there seems no shadow of doubt that the material composing the dunes, which so largely occupy the intermediate plateau, comes from the denudation of the arenaceous formations to the north, and not from the Nubian Sandstone to the south. The disposition of the dunes suggests such an origin, and positive evidence can be adduced, as we shall show, that at the present day the prevailing winds are from the north, and that the dunes have a steady and appreciable movement from north to south. The post-Middle Eocene formations occupy a wide belt along the northern side of the Libyan desert, and the supply of sand made available by the denudation of the arenaceous deposits exposed over this area is inexhaustible. During the passage of the sand across the great central limestone tableland the individual grains of silica doubtless become much rounded and reduced by attrition; the loss is, however, to some extent counterbalanced by the very considerable additions—in the form of calcareous grains—derived from the limestones forming the surface of the high desert.

It would be extremely interesting to sample the Abu Moharik dune-belt at different points along its course, in order to ascertain whether there is a sensible and regular increase of calcareous matter from north to south. Examination shows that in the oasis of Kharga, to the south of the limestone plateau, the dunes are by no means composed solely of siliceous grains, there being a considerable proportion of white opaque granules of limestone. A sample collected from one of the dunes in the central part of the depression was found on analysis to contain 7·7 per cent. of calcium carbonate.

It would be difficult to account for the presence of calcareous grains in the dunes of this locality on the assumption that the sand is derived from the Nubian Sandstone; though the denudation of the latter, in and to the south of the oases of Kharga and Dakhla, must give rise to a very large amount of siliceous sand, which goes to swell the bulk of the dunes which have invaded this country from beyond the limestone plateau to the north.

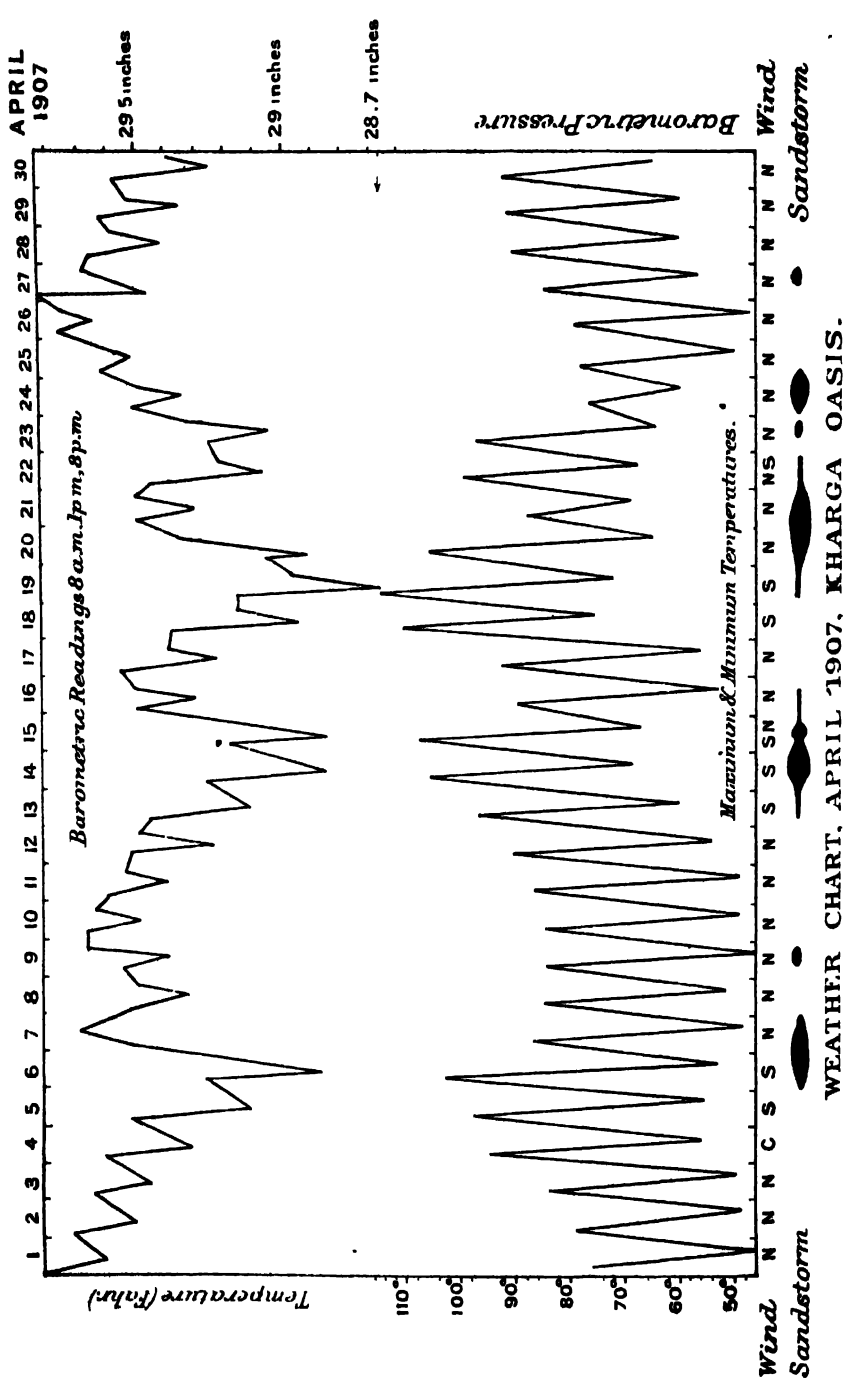
In desert regions, owing to the ground being unprotected by vegetation, there is nearly always an abundance of weathered material loosely exposed on the surface, the lighter portions of which are quickly swept up and carried along as soon as the wind attains even a moderate velocity. In the Libyan desert the temperature seldom falls below freezing-point, and the climate is so dry that frost plays but little part in the disintegration of rock-surfaces. The diurnal range of temperature is, however, very great, and this force—"insolation," as it has been termed—is very potent in the breaking up of the surface. The weathered material does not accumulate and form a protective soil-cap, but is carried away by the wind (deflation), the heavier siliceous grains effecting an immense amount of abrasion of the exposed rock-surfaces over which they are swept.

Changes of temperature, sand and wind are, indeed, the chief agents of erosion and transportation in the Libyan desert at the present day, and, since the incoming of the modern desert conditions, have not only produced the material which has in places accumulated and formed the dunes which are the subject of this paper, but have effected a vast amount of earth-sculpture over the surface of the region as a whole.

(*c*) *The Desert Winds.*—In the abrasion of rock-surfaces, in the movement and accumulation of the weathered material, the wind is the guiding power, while sand is the instrument or tool. The combination of the two forms a denuding force of no mean power, the sand-blast being capable of planing and grooving the exposed surfaces of the hardest of rocks.

The actual amount of erosion effected, and the rate of movement, distribution, and accumulation of sand-dunes, depend on the velocity, direction, and frequency of the wind, so that no conclusions formulated on these questions can be regarded as satisfactory which are not based on a study of the local meteorological conditions.

An extended residence in the oasis of Kharga enabled me to have meteorological records kept over a period, and of considerable sufficient exactness to yield valuable information concerning the direction and duration of the winds, the frequency with which they are visibly laden with sand, the occurrence of sandstorms, etc. In addition, I had observations made with a view to determining the air velocity required to enable sand to be carried in suspension, and the velocity attained by the wind in actual sandstorms.



WEATHER CHART, APRIL 1907, KHARGA OASIS.

It will be convenient to confine attention to one period of twelve consecutive months, and that extending from April, 1907, to March, 1908, is chosen. The results of these observations are tabulated below.

OBSERVATIONS ON THE MOVEMENT OF WIND AND SAND IN THE OASIS OF KHARGA. FOR YEAR ENDING MARCH 31, 1908.

	Winds.				Sand and Sandstorms.					
	North.*	South.*	Various.†	Calm.	Wind carrying sand across open plain.‡ N.	S.	Var	Sandstorms. N.	S.	Var
April, 1907 ..	21	6	2	1	6	3	–	3	2	—
May „ ...	19	—	8	4	7	—	—	—	—	—
June „ ...	29	—	—	1	15	—	—	—	—	—
July „ ...	29	1	—	1	6	—	—	2	—	—
August „ ...	22	—	7	2	7	—	2	2	—	—
September ...	30	—	—	—	14	—	—	4	—	—
October „ ...	28	—	1	2	6	—	–	—	—	—
November ...	23	2	—	5	9	—	—	—	—	—
December ...	24	1	1	5	5	–	–	—	—	—
January, 1908	20	6	3	2	—	6	3	—	—	—
February „	15	2	9	3	6	—	—	1	—	1
March „	21	4	3	3	9	1	—	1	—	—
Days ..	281	22	34	29	90	10	5	13	2	1
						105			16	
		337		29			121			
		Windy days.		Calm			Wind carrying sand.			

There is no reason to suppose that the period in question, from April, 1907, to March, 1908, was other than a fair average sample of the general climatic conditions obtaining at the present day in the Libyan desert; and although it is desirable that the observations be continued for a term of years, the results obtained from the twelve months' record tabulated above are sufficient for our present purpose.

The main facts established by these observations are, that the ratio of calm to windy days is very small, being 1 to 11·6; that on one day in three the wind attains a velocity sufficient to enable it to carry sand in suspension (and this across the open plain, away from the sand-belts); that five times out of six the direction of the wind is from the north; and that by far the greater number of the sandstorms is also from the north.

Space prevents me from doing more than call attention to the meteorological conditions—increasing temperatures accompanied by a falling barometer—which culminate in and are relieved by sandstorm weather, as shown so well in the accompanying weather chart for the month of April, 1907 (Fig. 2).

* Or within a few points. † Winds with distinct east or west points.
‡ Visibly charged with sand.

(*d*) *Wind Velocities.*—Observations made with an air-meter under different conditions of wind, on the open plains and on the dune-belts, show that—

(1) On the dunes the sand commences to move when the wind attains the velocity of a light breeze, or 13 miles an hour.

(2) On the open plains the wind becomes visibly charged with sand as soon as it approaches the velocity of a moderate breeze, or 23 miles an hour.

(3) Sandstorm conditions obtain when the wind exceeds the rate of movement of a moderate breeze, the maximum velocity actually recorded in the period under observation being 34 miles an hour, during a violent sandstorm on April 14, 1907.

N.B.—The observations were made about a metre above the ground. The terms "light," "moderate," etc., are used as in the Beaufort Scale.

(*e*) *Desert Barchans or Crescentic Dunes.*—The dominant form of dune in the Libyan desert is of crescentic or horse-shoe shape, a form specially typical of desert regions where there are prevailing winds in any one direction. These "barchans," * as they are called, are found of every size, and exhibit many variations of the simple crescentic pattern. In the region of the oases they are always disposed with the concave, steeply-inclined sides facing southwards. In some parts of the Libyan desert, more especially in the oases-depressions, the sand-belts are made up of numerous isolated and apparently promiscuously-disposed barchans; in other cases the dunes have joined together into a compact mass, in which the typical shape of the individual barchan is more or less obliterated. In the great sand-massifs the uppermost portions of the sand are arranged in longitudinal (north and south) ridges, made up of intergrown dunes of the barchan type; and the deep so-called "fulges" appear in most cases to represent the hollows immediately in front of the steep lee faces of individual dunes, the horns of which have met and united with preceding dunes.

Solitary barchans, being well-defined isolated masses, lend themselves to observation better than the large and continuous belts of sand. They occur of all sizes, from little baby crescents, a metre or two across their greatest span, to enormous masses 30 or 40 metres high and 200 to 300 metres in breadth. The angle of slope within the crescent of a barchan is most deceptive, especially when the dune is approached from the south side in bright sunlight. I have frequently heard it confidently stated that the inclination of the face of the dune cannot be less than 60° or 70° from the horizontal, and quite recently, in a published account of some dunes in the Nile valley, I noticed that the author estimated the inclination at from 40° to 50° degrees. Measurement, however, shows that the slope of the lee face never exceeds by more than 2° or 3° a third

* A short account of these dunes has already appeared in 'An Egyptian Oasis.' John Murray. London: 1909.

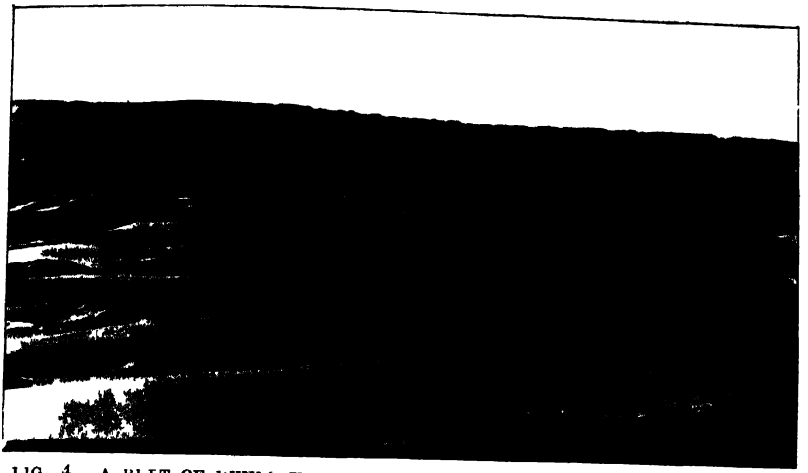


FIG. 4 A BELT OF DUNES IN KHARGA OASIS, LOOKING NORTH OR UPSTR

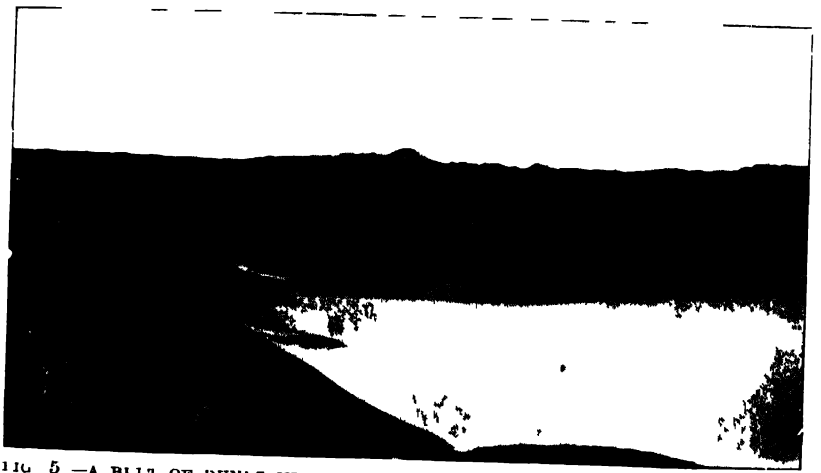


FIG 5 —A BELT OF DUNES IN KHARGA OASIS, LOOKING SOUTH OR DOWNSTREAM

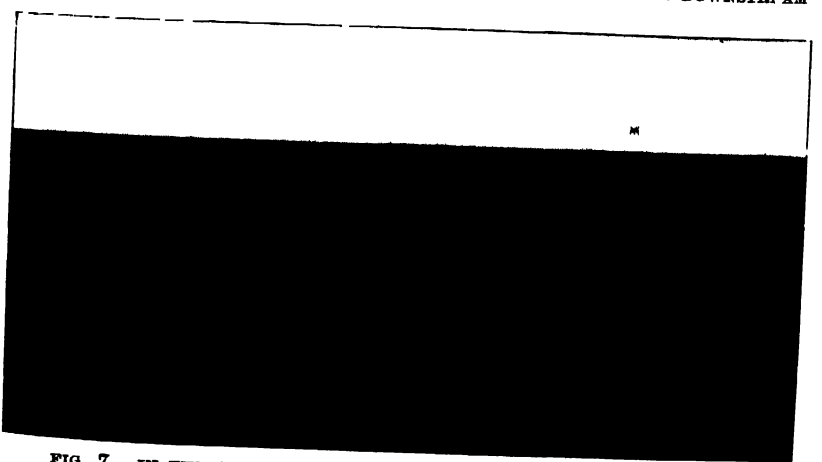


FIG. 7.—IN THE SEA OF SAND BETWEEN DAKHLA AND FARAFRA OASES.

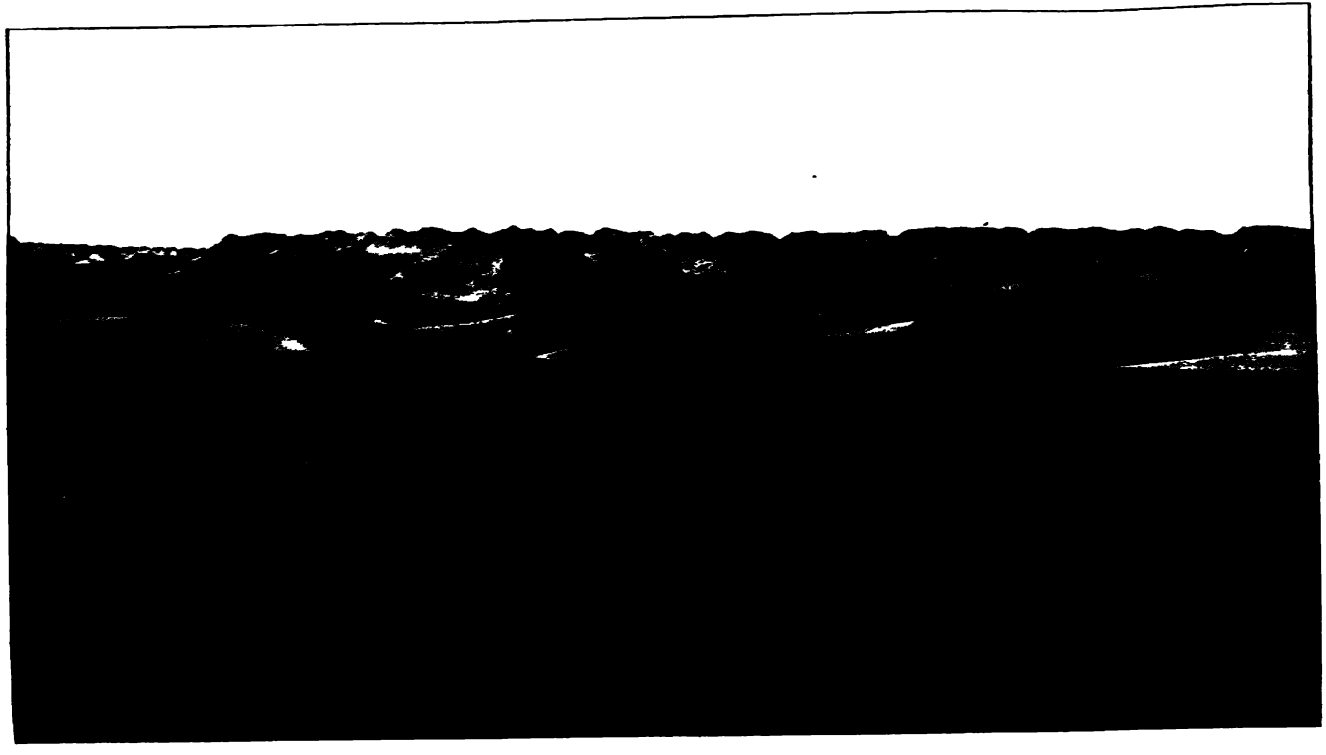


FIG. 6.—ISOLATED BARCHANS OR CRESCENTIC DUNES IN KHARGA OASIS.

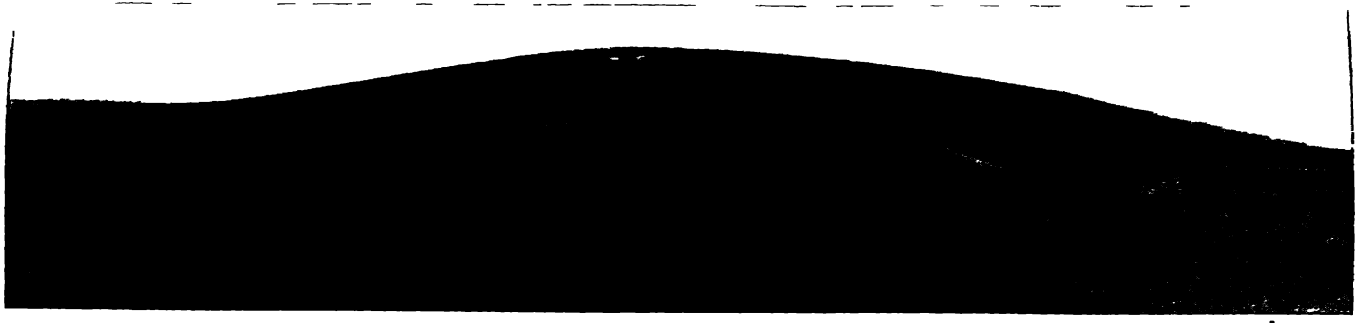


FIG. 9.—A TYPICAL BARCHAN: THE KHARGA ROAD DUNE.



FIG. 10.—A COMPLEX DUNE ON THE LIBYAN PLATEAU.

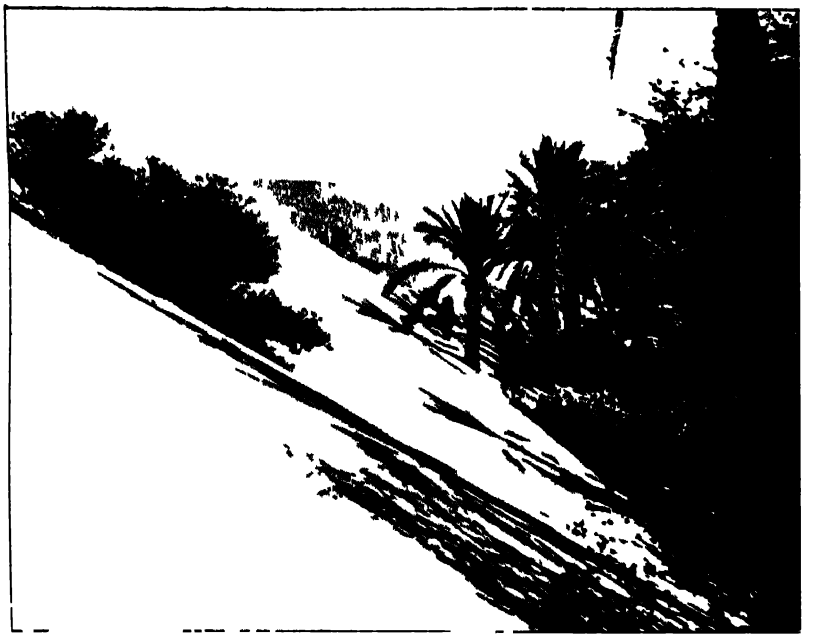


FIG 8 DUNES ENCROACHING ON THE CULTIVATED LANDS IN DAKHLA OASIS



FIG 11 —SECTION SHOWING INTERNAL STRUCTURE OF A BARCHAN

of a right angle, as, unless held together by vegetation or compacted by moisture, it cannot exceed the "angle of rest" of dry blown sand, which varies from about 31° to 33°.

In normal weather the leeward southerly face of a barchan is a straight, unrippled, even slope of loose sand from top to bottom. When a light or gentle breeze is blowing from the north, the dune is observed to "smoke" at the top of the crest, the sand being blown up the much more gentle and markedly-rippled windward slope, and dropped over the crest on to the steep, smooth, southerly face. In a light breeze the bulk of this sand falls on the upper part of the slope, equilibrium being adjusted from time to time by a downward sliding of the superficial layers.

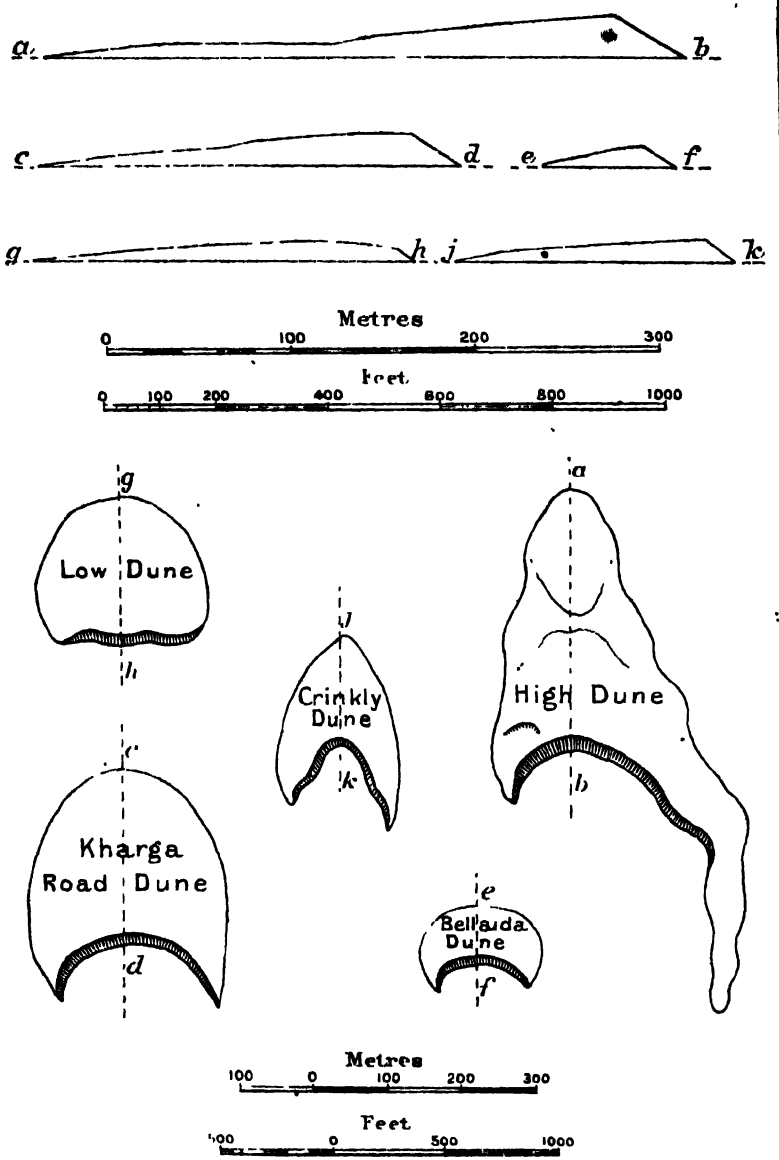
In one of his articles, Dr. Cornish * writes as follows:—

"The upper part of the lee slope of the more developed and middle part of the dune is the well-known straight cliff which has a soft, unrippled, slipping, plane surface. It has been customary to ascribe this slipping cliff to the pushing of sand-grains over the crest by the forward action of the wind and their downward rolling. This explanation implies that the cliff is constantly refaced by sand-grains thus driven forward from the surface of the windward slope. What I saw on this and other dunes during my stay in Egypt convinced me that this notion is incorrect. The cliff is due to undercutting by the backward-acting eddy."

This explanation has never commended itself to me—at any rate, as regards the dunes of the Libyan desert—and an examination which I recently made of the internal structure of a typical barchan in the oasis of Kharga seems to conclusively prove that the older view is the more correct. About sixty gallons of water were carefully poured out at a point on the summit of the crest of the dune, after which a trench—running north and south, at right angles to the trend of the ridge—was cut through the consolidated mass, which was then plainly seen to be made up of well-stratified layers dipping regularly southwards at a little over 30° (Fig. 11). Each layer had in turn formed the lee face of the dune. There is no doubt, therefore, that, at any rate in the case of the isolated barchans of the Libyan desert, the dunes progress, and the steep southerly leeward faces are formed and renewed, by the sand which is constantly blown up the northerly windward faces and dropped over the crests in the manner already described.

In Kharga oasis I have never observed southerly winds hold for a sufficient length of time to do more than slightly modify the general form of a large barchan, though during their continuance the progress of the dune is arrested, the outline of the crest becomes markedly

* "On Desert Sand-dunes bordering the Nile Delta," *Geographical Journal*, vol. 1, p. 7.



BARCHANS IN KHARGA OASIS.

IN PLAN AND CROSS-SECTION.

FIG. 8.

altered, ripple-marks appear on the steep southerly face, and an apron of sand of greater or lesser dimensions forms at its foot.

(*f*) ***Rate of Movement.***—The rate of movement of desert dunes has never, so far as I am aware, been studied in any great detail, and the few figures with which I am acquainted, regarding the movement of coast dunes, appear mostly to be based on observations extending over only short periods of time. Dr. Franz Czerny * states that, according to Koch, the dunes on the Baltic coast in Courland move at the rate of 18 feet a year, and according to Bramontier † the dunes of Gascoyne were, at the end of the eighteenth century, moving at the rate of 20 to 25 metres a year. Dr. Vaughan Cornish ‡ found the average rate of advance of the crest of a dune near Ismailia to be about three-quarters of an inch an hour, the measurements being made in April, 1899, during two or three days when northerly winds prevailed. Mr. C. R. Enock has estimated the movement of barchans in South America as amounting to as much as 1 or 2 feet an hour in a brisk breeze.§

Observations extending over two years show that in the Libyan desert the dunes progress steadily southwards at an average rate of 15 or 16 metres a year. The greatest recorded movement of a barchan in twelve months amounted to 20·6 metres, the lowest to 10·2 metres.

The five dunes, of which the measurements are given below, and which are shown in plan and section in the accompanying illustration (Fig. 3), are situated in different parts of the oasis of Kharga. The low, high, and crinkly dunes are members of the dune-belt which runs near and parallel to the eastern wall of the depression; the Kharga road dune lies in complete isolation on the open plain in the centre of the oasis-depression; while the Bellaida dune, in the district of that name, is one of a belt of barchans to the west of Jebel Têr, on the west side of the depression.

Name of dune	Maximum measurements in metres.			Notes.
	Height of crest.	Length N. to S.	Breadth E to W	
Bellaida dune ...	10·5	70	160	The highest point of each dune is the actual crest above the steep southerly slope, except in the case of the low dune, where the highest point is 60 metres to north.
Low dune	4	205	230	
Crinkly dune ...	11	150	160	
Kharga road dune ...	17	230	260	
High dune	20	350	260	

* "Die Wirkungen der Winde auf die Gestaltung der Erde," *Petermanns Mittheilungen*, Ergansungsband xi., 1876-77.

† Reclus, 'La Terre,' vol. 2.

‡ *Op. cit.*, pp. 4, 5.

§ *Geographical Journal*, vol. 31, p. 684.

The dunes move in the same direction as the wind, and the amount and rate of movement depend directly on the duration and velocity of the wind. As stated above, the barchans in the oasis of Kharga were found to commence to move when the wind attained a velocity of about 18 miles an hour, and in light and gentle northerly breezes (18 to 20 miles an hour) to progress steadily in a southerly direction without loss or gain of sand, the superficial layers being rolled gently up the windward slopes and dropped over the crests on to the steep lee slopes facing southwards. In stronger winds, when the air becomes everywhere charged with sand, the dunes progress still more rapidly, and may, according to circumstances, be either gaining or losing in actual bulk. Much sand is blown away to the south, while additions of material are received from the north. When sandstorm conditions prevail (30 miles an hour or over), the rate of movement reaches a maximum, amounting to between 2 and 3 centimetres an hour.

Between June 29, 1907, and July 8, 1908, a period a few days in excess of twelve months, the dunes under observation moved from north to south as follows:—

Bellaida dune	18·78 metres
Low dune	18·38 „
Crinkly dune	16·18 „
Kharga Road dune	10·80 „
High dune	10·94 „

The average movement of the five dunes works out at 15 metres, the results indicating that the rate of movement depends in large measure on the size of the dune. The larger the dune (in longitudinal section, from north to south), the greater the amount of material to be moved, so that, as a general rule, small barchans progress more rapidly than large ones.

The following table shows the monthly movements of the five dunes during the year 1908. On the whole the results agree closely with those for the period quoted above. The months of August, September, and October of 1908 were, however, remarkable for three prolonged periods (of five, ten, and nine days respectively) of sandstorms from the north, and the movements of the dunes for those months are in consequence very high. It would seem that strong winds affect the high dunes more than they do the lower ones, as, owing to the excessively marked movements of the high dune in the latter months of the period, its total progression for the year almost equals the average of the three smaller dunes. Curiously, however, the movement of the isolated dune on the Kharga road varied little.

MOVEMENT OF DUNES IN THE OASIS OF KHARGA, 1908.

Name of dune.	Low.	Bellaida.	Crinkly.	Kharga road.	High.	Average monthly movement
January	1·27	1·74	1·10	1·19	0·74	1·21
February	1·01	1·54	1·45	0·38	0·46	0·97
March	1·15	1·41	0·85	0·65	0·76	0·96
April	2·25	2·40	1·63	1·20	1·19	1·73
May	1·04	0·65	0·98	0·15	0·30	0·62
June	2·34	2·45	2·07	1·45	1·89	2·04
July	0·43	1·09	1·71	0·44	0·47	0·83
August	1·77	2·16	1·58	1·11	2·13	1·75
September	2·65	2·82	3·18	1·65	3·35	2·73
October	2·70	2·33	2·45	1·30	3·22	2·40
November	1·10	1·80	1·25	0·70	2·65	1·46
December	0·25	0·40	0·65	0·00	1·40	0·54
Total movement during period, in metres ...	17·98	20·59	18·90	10·22	18·56	

(*g*) *General.*—The limits of the present paper preclude going into further details regarding the relation of the sand accumulations to the general configuration of the desert surface. Suffice it to say that, although in many instances sand-belts are found to continue, regardless of topography, in almost straight and unbroken lines, as a rule lowlying areas and depressions become centres of accumulation, while on the highest and most exposed portions of the plateaux blown sand seldom collects in any great quantities. Other important questions are the effects of vegetation and moisture in the fixing of dunes, and the raising of the cultivated lands in certain parts of the oases as the result of the constant accumulation of blown sand and clay dust. These I have described elsewhere.

The vast amount of earth-sculpture which can be accomplished by a combination of sand and wind is now generally admitted. It has even been suggested * that under the impact of blown sand ordinary limestone may become hardened and be rendered crystalline; but, as I have stated elsewhere,† until it can be shown that the crystalline limestones, which are of such common occurrence in the Libyan desert, bear some definite relation to the desert surface, and that a rock can withstand the wearing action of blown sand for a sufficient period to sustain internal physical alterations, the theory can hardly be expected to obtain credence.

Finally, I wish to place on record my appreciation of the assistance I have always so willingly received in my study of sand-dunes from Mr. P. von Adametz and Mr. C. Bayly, and last, but not least, from the late

* Dr. W. F. Hume on "The South-Western Desert of Egypt," *Cairo Scientific Journal*, August and September, 1908.

† *Cairo Scientific Journal*, January, 1909, p. 27.

Dr. H. H. Baker, whose recent and sudden death in British East Africa is so much deplored by those with whom he was for so long intimately associated in the oasis of Kharga.

Dr. STRAHAN: The paper for this afternoon's consideration is on the Sand-Dunes of the Libyan Desert, by Mr. H. J. Llewellyn Beadnell. Mr. Beadnell has recently returned from Egypt, and we welcome his attendance at this meeting.

Dr. STRAHAN (after the paper): This is an important communication on a subject which has been a good deal before the Society of late years, and which I think may, with great advantage come before the Society again, for it is essentially of geographical interest. I hope to hear a good discussion upon it this afternoon.

Dr. VAUGHAN CORNISH: I congratulate Mr. Beadnell on the excellent work he has done. It is a great satisfaction to me to see desert dunes made the subject of residential research. It is hardly possible for the passing traveller to carry the study beyond the pioneering stage. The observations of the rate of movement of the barchans in connection with a systematic record of wind velocities is much the best thing of the kind which I have yet come across. A very interesting point comes out in respect to the change of *tenue* when we pass from gentle and moderate breezes to a period of storms. During twelve months, when the winds were mostly moderate, the barchans progressed in the inverse order of their cubic contents, and the highest dune moved slowest. But in a succeeding period of three stormy months the highest dune moved at a greater speed than any of the others. When the winds are light the lee of a high dune is a place of calm and shelter. When, however, the wind is violent, it is on the lee of the highest cliff that the strongest vortex is induced, with the greatest power of transporting sand in suspension.

With regard to Mr. Beadnell's remarks upon my description of the action of the vortex on the lee of the dunes near the Nile delta, I must point out, first, that they were transverse ridges and with loose sand below the troughs, not barchans isolated on hard ground. Secondly, I wrote more particularly of what takes place when the wind is blowing with at least moderate velocity. In very light winds no doubt the sand drops gently over the crest. I do not think the stratification found by Mr. Beadnell is really an argument against my description. The process he describes culminates in bodily sliding. So does that described by me, and both processes give the same stratification in the cliff.

The barchan has great morphological interest. Its ichthyomorphic character was pointed out in my paper on Snow Waves in the *Journal*. It is not itself a completed structure. It is like part of a flat fish, say a sole, and the rest of the fish is represented by the space where the wind is eddying and sweeping back to the barchan the loose sand on the ground.

In conclusion, I should like to ask Mr. Beadnell if he finds the movement of sand is dependent only on the velocity of wind, or if he has observed that the sand is thrown into suspension in an excessive degree by winds blowing during an electrified condition of the atmosphere.

Mr. LAMPLUGH: May I ask whether, in the country Mr. Beadnell has examined, he has seen anything that would throw light on the curious sand-bults of South Africa, where huge masses of sand covering a great part of the Kalahari and surrounding country appear to be blown sand, and yet present no definite blown-sand forms. These long, broad, flat-topped "bults" or swells are now all covered with bush and are fixed. In the parts that I traversed, I tried to find traces of degraded or altered dune-forms in them, but could never do so. I notice that Mr. Beadnell shows on his map a long river-like belt of sand, made up of dunes, running across a stony desert. Does he think it possible that a belt of this

kind might become degraded to a smooth broad flat, with a gently bulging cross-section?

Mr. HOGARTH: The only thing I wish to ask about is the wind eddy. I rather gather that Mr. Beadnell does not very much believe in it. Does he think it possible that a dune can become immovable through the wasting effect of the eddy on the lee side? I think he mentions a particular dune within his area of observation which he says appears to be almost stationary. Is that fact due to the wind eddy? I have never, of course, studied these things scientifically, but am interested in that curious Arabian problem of the great hollows upon the lee side of dunes, which Beduins know as *fal̄jes*, and which in certain cases go apparently right down to the native rock. They offer, I think, absolute evidence of wind-scouring; these cannot be simply the hollows within the crescent of the barchan, because the floor is clean. It is not a place where the sand is being continually thrown by a direct wind. Another fact about *fal̄jes* does not depend upon scientific observation, but on the memory and statements of Beduins. So far as those statements go, they declare that the hollows remain in the same place generation after generation. The Beduins know this, because they use wells in them, and various travellers who have crossed them have used them as camping-grounds. If we are to believe Beduins, we have in these cases to do with dunes which are at rest, and in which the great hollow has come to rest. I would only ask Mr. Beadnell whether he has any observations he can give us which might tend to explain that fact? I have one other question to ask. That great sand-buried tract upon the west of the oasis of Dakhleh—while he was in the oasis, did he learn that the natives at any time crossed that belt? Is there any direct communication with the line of oases which runs south towards Wadai, or is it the case that all communication between the two belts of oasis takes place by a great circuit round the north? If so, that of course explains why the Senussis chose Jarabub, which is exactly at the northern point of that sand tract, as their centre during the last century. No European has ever crossed that belt.

Dr. OWENS: I have not had the opportunity of reading the paper, but in connection with the rate of travel of the dunes, it occurs to me that to connect up the velocity of the wind and the rate of travel, it would be advisable also to have the size of grain of the sand. If not in the paper, I should think Mr. Beadnell has got the information. One other point. With reference to the origin of the desert sand, is there any suggestion as to what becomes of the dust or finer material which must have been mixed with the sand at some time? I really know very little about the travel of desert sand, but it is a matter of observation that in water the finer material or mud is more easily moved and travels further than the sand. Why is it that the fine material has disappeared from desert dunes and we have got nothing but the sand?

Rev. W. E. TAYLOR: I should like to ask Mr. Beadnell if he has ever met with the phenomena of the sounds produced by dunes—the musical sounds that are reported to be heard in different places where dunes exist?

Captain TIZARD: I can answer that question, for I have heard them in the peninsula of Sinai, close to Tor. There are large stationary sand-dunes there, very high, and the sand as it slides down makes, in still weather, these musical sounds. I should like to make one observation with reference to Dr. Cornish's statement, about the shape of articles propelled through the water, and that is, that as a boy I was taught to tow a spar thick end forward; how they have lost the knowledge that the resistance is less if the thick end is propelled first I do not know.

Dr. STRAHAN: It has been a great privilege to hear this paper from one who is

both a geologist and a geographer. To me it presents many points of novelty. I had no idea that blown sand crossed the desert in such narrow straight streams as are shown upon the map. Why it should be confined to those channels I do not know. The straightness, narrowness, and the uniformity of width is certainly most remarkable. The source of the sand, as pointed out by the author, seems to be sufficiently obvious, and it might be worth while to ascertain whether the sand which has travelled the farther is the more completely rounded or the finer in grain. Where the finest material has gone to I suppose nobody can say, but I notice the author's remark, that in certain parts of the desert natives are collecting fine dust for the purpose of forming soil. We have opportunities of studying blown sand, though not on this continental scale, in this country. We have the advantage here of often being able to stop its encroaches by running streams. In rainless regions the difficulty of stopping an invasion of sand becomes great, but it seems to be one of those cases in which the geographer can make observations of considerable practical value. On that account, and on account of the scientific interest of the matter, I look forward to further communications on the same subject. It only remains for me now to ask Mr. Beadnell to reply to the various questions which have arisen in the discussion.

Mr. Beadnell: I stated in my introductory remarks that the subject of dunes could be approached from many points of view, and the questions which have been asked in the discussion have brought this out very much. I fear Mr. Lamplugh has gone, but I do not think I could have given him very much information about the sand-belts he speaks of in South Africa. It seems to me that the only way sand-belts—such as are found in the Libyan desert—could become degraded to a flat surface, would be if they became for a time submerged. So long as they remained on the desert surface they could never get into that condition unless the region became a windless tract.

I was much interested in the blackboard demonstration which Dr. Vaughan Cornish has given us, illustrating his views regarding the movement and origin of form of desert dunes; this is a branch of the subject which Dr. Cornish has made his special study. Concerning the leeward slopes of desert barchans, regarding the formation of which Dr. Cornish and I hold different opinions, perhaps he will tell us whether he suspects that the dunes studied by him were formed under different conditions to those which I had under observation?

Dr. Cornish: It is not so dry; there is more ground moisture.

Mr. Beadnell: The question is of such importance, that I hope Dr. Cornish will find an early opportunity of reinvestigating the subject. I too have met with examples of sand-tongues running out from the centre of the crescent, and here I am inclined to agree with Dr. Cornish's explanation of their being formed by wind eddies from either side.

In reply to Mr. Hogarth, the "fuljes" with which I am acquainted in the Libyan desert are the hollows formed where the horns of a crescentric dune have joined another in front of it; these occur not only on the plains, but high up on the summits of the belts of sand. As to whether hollows can be produced and kept clear of sand by wind-scour, I am not able to express an opinion. Certainly I have seen nothing of the sort in the Libyan desert.

With regard to the sand-submerged desert to the west of the oases, you will recollect that the members of the Rohlfs expedition attempted to cross that country from Dakhla to Kufra, but at a distance of some five or six days' march from the former oasis, were compelled to turn and travel in a north-north-westerly direction, parallel to the ridges of sand, a route which took them out of the dunes in the neighbourhood of the oasis of Siwa.

Mr. Jennings Bramley also made an attempt some years ago to cross from Dakhla to Kufra, but I believe his guides failed him after two or three days. The last man who attempted to penetrate to Kufra was Mr. Harding King. It was reported in Cairo that this gentleman had got within sight of Kufra and then returned to Dakhla, but, in the absence of any definite statement, one must accept the report with considerable reservation.

That country is practically impossible to travel over in an east-and-west direction, unless one carries very large supplies of water. I have never come across a native who had actually accomplished this journey. When I was in Iddaila—an uninhabited oasis to the west of Farafra—I met some Senussi Arabs who were on their way from Kufra to Dakhla, having travelled by way of Siwa. Of course they may have had special business in Siwa, but my opinion is that that is the only feasible route. Traces of an old road running from Dakhla in the direction of Kufra do, however, exist, but it is probable that since this road was in use the sand-massif has progressed a considerable distance southward. It may still be possible to reach Kufra from Dakhla by making a wide *détour* to the south.

The size of the grains composing the dunes is doubtless a consideration of some importance, but I have not had time to make any observations myself in this connection.

The derivation of the material composing the dunes has been discussed at some length in my paper. The origin of the dunes themselves is an aspect of the subject which would well repay study. A careful survey of the region in which these sand-belts originate, is required in order to ascertain whether any special conditions govern their birth. I believe that some of them start in lowlying country, and possibly as anchored dunes. In connection with their rate of movement, it is important to know more accurately where the belts originate and terminate, as it does not necessarily follow that a belt as a whole advances at the same rate as that of its component dunes.

With regard to musical sand, I have never noticed this phenomenon in dunes.

In answer to Dr. Strahan, I do not think we are likely to discover the reason why some of these sand-belts are so narrow in proportion to their length until a careful examination has been made of the country in which they originate—that is to say, the desert immediately to the south of the great post-Middle-Eocene escarpment.

As to the fineness of the sand, I think it is natural to conclude that the grains become reduced in size as they travel southwards, and doubtless very much of the finest dust is blown away from the dunes on to the surrounding desert. Probably the extensive alluvial deposits in the south of Kharga oasis (where lakes existed in early historic times) are largely composed of this fine material.

It only remains for me to add how much I appreciate your kind reception of my paper.

PROBLEMS IN EXPLORATION—CENTRAL ASIA.*

By ELLSWORTH HUNTINGTON.

SINCE the revival of geography in the days of Columbus geographers have been zealously mapping the world and writing empirical descriptions

* In writing this paper, the author has made use of some of the material from a paper on "Desiderata in Exploration—Asia," by the late Mr. Ney Elias, with additional notes supplied by Sir T. H. Holdich and Sir Francis Younghusband.

of its various portions. They have been so absorbed in this important task that they have had comparatively little time to ponder on the great problems of why specific parts of the Earth's surface present a certain appearance and how they can best be described. Nor have they done much toward determining why certain species of living beings are grouped together, or of why special modes of human life and peculiar types of activity are distributed as we now find them. It is not surprising that such has been the case, for a science grows like a human being. We do not expect a child to read while it is learning to talk, and we cannot expect a science to devote its time to arranging and explaining its facts while it is still expending its energies in getting them. At last, however, the purely exploratory and descriptive stage of geography is nearly completed, and we are already embarked upon the explanatory stage, which bids fair to be even more interesting than its predecessor. The explorer who has tasted the keen joy of pushing his way through some hitherto unknown country is apt to sigh for the days when America, Africa, Australia and a large part of Asia were still unknown. Those, it seems, were the halcyon days of geographers, the time when it was joy to live. A broader view, however, shows that the most fascinating days of geography are still before us. There is surely as much pleasure in the discovery of an idea as in the discovery of a lake. It is a splendid thing to cross an unexplored continent, but it is no less splendid to ascertain why the people of that continent possess a fundamental characteristic which does not pertain to the people of the rest of the world.

Few portions of the Earth's surface offer problems of greater interest than those of Central Asia. For our present purpose Central Asia may be defined as the vast area extending from the Caspian sea and the Zagros mountains on the west to the borders of China Proper on the east, with the Arabian sea and the Himalayas on the south, and the plains of Siberia on the north. It consists primarily of three great basins and two plateaus. The basins are, first, that of Iran, including the countries of Persia, Afghanistan, and Baluchistan; second, the eastern portion of the Aralo-Caspian basin generally known as Russian Turkestan; and third, the basin of Chinese Turkestan or Lop. The plateaus comprise the vast bulk of Tibet with its westward extension into the Pamirs, and the plateau of Tian Shan lying north of the Lop basin on the southern confines of the great Siberian plain. In addition to these five great features there are numerous minor basins and mountain ranges. Climatically the entire region is characterized by a relatively high degree of uniformity, although of course there are marked contrasts between the highlands and the lowlands. Except for the mountainous regions, Central Asia is a land of deserts, and is either far removed from the ameliorating influences of the sea or else cut off from them by mountains; hence it is characterized by broad tracts of

arid plain ringed about or dotted here and there with oases lying either at the base of the highlands or along the main rivers. Summer rains, except in the northern portions, are rare; and dry, sub-tropical conditions prevail from spring till fall. In the winter, however, when the climatic belts of the Earth shift southward, Central Asia lies in the zone of prevailing westerly winds, and in most parts receives a fair amount of rain from cyclonic storms. The ever-present contrast between great uplands and low plains, and the climatic uniformity of the country, give to Central Asia a distinct unity, and cause the main geographical problems of all parts to be closely allied.

Pioneer Exploration.

Although the work of pioneer exploration in Central Asia is almost finished, there are still a few interesting bits to be done, and these should be mentioned before we discuss other problems. The two chief regions where this is the case are Afghanistan and Tibet. A generation or two ago Afghanistan was partially explored; but during recent years it has been almost inaccessible. No one has been permitted to travel there except under close surveillance, or on the borders, where British and Russian boundary commissions have been at work. Thus, although the main features of Afghanistan are known, there are large areas which still require exploration. For instance, the course of the Heri Rud, the river of Herat, and the only stream which escapes from the interior of the basin of Iran, has never been completely mapped, and the same is true of parts of the Helmund. Farther toward the centre of Asia, in the north-east corner of the country, large portions of Badakshan and Kafiristan are entirely unknown. It would be hard to find any scientific task more interesting than the exploration of this region, and a study of its wild pagan inhabitants, the bold Kafirs and other strange tribes. At present, however, such exploration is practically impossible, because the English and Russian Governments support Afghanistan in her complete interdiction of the entrance of European travellers, and because the mountaineers of Afghanistan are among the fiercest of the Earth's inhabitants.

In Tibet there are still fairly large blank spaces upon the map, but the major features are all quite well known with one exception. South-eastern Tibet is as yet unexplored. The river Tsangpu of Tibet is supposed to be the upper portion of the Brahmaputra of Assam, but no one has ever actually proved this to be the case. Its course for several hundred miles through the Himalayas is unknown. "Even the Tibetans know nothing as to what becomes of their greatest river. When asked at Lhasa to give permission for a party of British officers to return to India down the river they readily granted it, and even deputed an official to accompany the party to the border of Tibet. But they added that no one knew whether the river went to India, or indeed

where it went. In Tibet it is 11,000 feet above the sea, and is a magnificent river 200 or 300 yards in width. It runs parallel to but at the back of the main axis of the great Himalayas. Where it is next known it has broken through the Himalayas, and is only 500 feet above the sea. What falls and rapids there are, and what gorges the river has cut, remain for the explorer to tell us.

"Between the limits of Tibetan territory and the boundary of Assam there are a number of independent tribes more or less inimical to the presence of Europeans. It was because of the likelihood of troubles with these tribes that the Indian Government refused permission for a British party to proceed down the Brahmaputra as Major Ryder and Captain Rawling proceeded up the river after the signing of the Treaty of Lhasa. The difficulties are now further increased by the unlikelihood of the Tibetans again granting permission for a party to proceed through Tibetan territory. The psychological moment was lost. But the relations of the Indian Government with the tribes between Assam and Tibet may improve, and an opportunity may be found of penetrating this country; and fortunately it is in that part, and before the Tibetan border is reached, that the solution of the great geographical problem will be found. It is on that portion, therefore, that the attention of geographers should be focussed." *

Minor Exploration.

In addition to the two main regions of exploration in Afghanistan and Tibet there are a number of smaller but very interesting districts still to be explored. One of these is the Persian desert of the Lut. This has been traversed many times, but there are still parts which no one knows. For instance, west of Seyistan lie the barren mountains of Palan Kuh, the Panther range, which may perhaps contain ruins of ancient towns or other interesting phenomena. In the Trans-Caspian desert there are also regions which would well repay exploration. No one has ever followed the entire course of the Yuzboi and of the Ungus, the supposed ancient channels of the Oxus river. A thorough exploration of these would throw most interesting light upon the fluctuations of the Aral and Caspian seas, and upon the conditions of ancient civilization. Passing eastward to Chinese Turkestan, there are many regions both in the Takhla Makan desert and in the surrounding mountains which are only imperfectly known. For example, in the mountains to the south-west of the basin many vast glaciers and lofty peaks have never been properly mapped; and the source of the Oprang river, one of the main tributaries of the Yarkand, remains to be discovered. In the desert of Takhla Makan, which occupies the centre of the basin, there are large tracts which have

* See previous note.

never been traversed. It is not probable, however, that much will be found here by the traveller who is simply engaged in map-making, for the whole region is a monotonous, sandy plain, and almost the only possibility of interesting results lies in the discovery of ruins. At the eastern end of the Lop basin many maps show a number of lakes, Toli and others, to the south of Hami; but they are located by hearsay, and no one knows whether they actually exist. Possibly they were once connected with Lop Nor, or are the remnants of some other great lake; but it is useless to speculate until an explorer has gone there and mapped them. He would need to go in winter, for only then could his camels carry ice to serve for drinking-water in the great saline desert.

A third type of exploration deals with various minor problems. Except in the few places where the Russians have accurately mapped their own territory, almost innumerable mountains, streams, lakes, and villages are not accurately shown, or do not appear at all upon even the best maps. Off the main routes one can scarcely travel a day without finding such. For the traveller whose main interest is in map work there is plenty of minor exploration to be done wherever he may travel. Such work, however, is not that of the mature geographer. It should be delegated to assistants such as the native map-makers of the Indian Survey, or to beginners who are making their first journeys. The recent expeditions of Stein illustrate the high value of such map-making under the direction of competent leaders, who themselves are engaged in studying broad problems requiring something more than pure technical skill.

Geographical Problems.

The comprehensive study of geography, which succeeds the preliminary work of exploration and mapping, consists of the elucidation of various problems dealing with the distribution and grouping of different physiographic and animate types. In other words, the task of the geographer is to discover how and why various kinds of mountains, climates, and other physical features are distributed as they are, and then to see what effect these inanimate features have had upon the distribution of animate forms. In the broadest sense this includes not only the physical distribution of various species of plants and animals, but also the grouping of living forms in such a way that each geographical province is characterized by its own particular assemblage of animate types. It includes also the distribution of human occupations and modes of life, and also of political, mental, moral and religious characteristics so far as these occur in one region rather than another because of physical environment.

Central Asia is unusually rich in problems of the kind thus suggested, but only a few of the more important can here be

considered. For convenience they will be classified as follows: (1) inanimate or physiographic problems, including (*a*) orography, (*b*) drainage, (*c*) æolian action, (*d*) terrestrial magnetism, and (*e*) climate and changes of climate; (2) animate or ontographic problems, including (*a*) the effect of pronounced climatic or topographic conditions upon man, and (*b*) the distribution of human occupations and modes of life in response to the regional grouping of vegetation and animal life as determined by physical circumstances. The best work can be done only when the geographer enters upon his field of work with a clear conception of the type of problem or problems toward the solution of which he hopes to make a contribution. Each problem requires a distinct mode of treatment and an intelligent preparation by means of careful preliminary study. It is a great mistake for the traveller to set off haphazard, hoping that he may chance upon some interesting line of study. To be sure, he cannot avoid meeting interesting subjects, but the man who starts out unprepared or without a definite purpose is almost sure to be confused by the very multiplicity of subjects which cry out for his attention. Too much stress cannot be laid upon the value of accurate mapping, not done mechanically, but with a carefully framed purpose. Most of the subjects discussed in this paper require it; for whatever else geography may or may not be, it is fundamentally the science of the distribution of phenomena of all kinds upon the Earth's surface. It is only when the distribution of a given class of phenomena is carefully ascertained and mapped, that the way is open for reliable generalizations as to causes and results.

Orography.

Turning now to specific problems, let us take up those which pertain to orography. From Persia on the west to Tibet on the east and Tian Shan on the north, the mountains of Central Asia are rarely of the Alpine type. Many of them show evidences of having been uplifted as plateaus in times so recent that portions of an old surface of erosion still remain intact at high altitudes. So common is this phenomenon as to suggest that in general the greater mountain regions of Asia, and perhaps of the world, owe their origin, not to the uplift of individual ranges, but to the upheaval of broad plateaus of the Tibetan type which have since been carved by rain and ice and wind into forms like those of the Alps. A proper study of this problem requires a certain amount of geological training, but it is primarily a problem for the geographer. It would be of the highest value if some trained explorer were systematically to traverse the great central mountain masses of Central Asia from the Caspian sea to China, and to estimate how large a portion consists of genuine plateaus where remnants of ancient lowland surfaces of erosion now remain at high levels. In the Pamirs, for instance, many high mountains of apparently diverse geological structure have

surprisingly flat tops. In the western Tian Shan region tilted peneplains lie at an altitude of from 10,000 to 14,000 feet, and further east they lie at somewhat lower levels. A systematic study of these plateaus and of the forms which they assume under the influences of erosion would go far toward solving the problem of the origin of mountains.

In conjunction with such a study of plateaus it would be possible to investigate two other types of mountains, both of which occur in Central Asia. One of these is the so-called "block" type formed by the faulting and uplifting of blocks of the Earth's crust. How widely such mountains are distributed no one knows, because most travellers, being untrained in modern physiographic methods, have paid no attention to the matter. They have merely seen and mapped mountain ranges which they describe, perhaps, as having noticeably straight base lines and steep slopes. Further than this they have not gone, because their purpose has usually been mere exploration and not the elucidation of problems. In north-eastern Persia, in the province of Khorasan, block mountains are developed upon a large scale, and the same is true to a less degree in Chinese Turkestan west of Kashgar and in certain parts of the Tian Shan region, where they have been seen near Lake Issik Kul and in the peculiar basin of Turfan, which lies below sea-level. They appear to be of rather common occurrence, although the individual blocks are not usually of large size. It is probable, however, that a careful study would show that there is every grade of transition from vast uplifted plateaus, such as Tibet, through smaller plateaus, such as the western part of Kuraktagh, in the eastern Tian Shan region, to little tilted fault-blocks only a few miles long and a few hundred feet high, such as occur in the basin of Turfan.

Fault-block mountains are closely related to folded mountains, such as parts of the Siwaliks of Northern India, and the two would naturally be studied together. The only difference is that in the one case the Earth's crust yields to a strain and breaks, whereas in the other case the crust is simply bent. Regions of faulting and of folding are often closely associated. For instance, fault-block mountains lie a day's journey to the west of Kashgar, and folded mountains a day's journey to the north. The latter are very young—so young that the original form given by folding seems still to be preserved, in spite of the fact that the low gently arching ridges are composed of unconsolidated alluvial deposits which are very readily eroded.

The problem of the origin and form of mountains is the reciprocal of the problem of the origin and growth of basins. A study of one involves a study of the other. At the present time there appears to be a tendency for the mountainous areas of Central Asia to increase in size at the expense of the basins. Along the borders of the Aralo-Caspian drainage area it seems as if in recent geological times a certain amount of territory had been heaved up, and thereby removed from what was

once the floor of the basin. The same appears to be true in the Lop basin. The best way to study this problem would probably be to take some basin and make a complete survey of its mountainous borders. It would be necessary to zigzag back and forth many times from mountain to plain. Such a course is naturally much more difficult than to travel straight along the base of a mountain range, but it is far more profitable. A properly equipped expedition might start at the Caspian sea and travel eastward along the mountainous borders of the Aralo-Caspian basin, and then go over into Chinese Turkestan. In Chinese Turkestan the main caravan might follow a route close to the foot of the mountains clear around the basin, while more lightly equipped parties could make side trips into the mountains at frequent intervals. In this way it would be possible to map the border of the basin and to determine the character of the uplift by which the plateaus and mountains were separated from the plains. It would also be possible to judge how recently the processes of elevation have been at work; to ascertain whether they are still in progress; to see what connection they have with volcanic outflows or hot springs; and to determine the relation of folded mountains, block mountains, and uplifted plateaus. Such a piece of work would require as much hardihood and as careful planning as any great piece of pioneer exploration in the same region; and its results would add enormously to our knowledge of the origin and structure of the irregularities of the Earth's crust.

Drainage.

Closely connected with orography are various problems of drainage. For instance, in Northern Persia the drainage follows a peculiar rectangular pattern. The rivers flow eastward or westward in broad valleys between fault block mountains, and then break northward and southward through narrow gorges for a few miles, and again turn east or west, sometimes repeating the process several times. Again, in the Kwen Lun mountains south of the Lop basin, there are numerous large rivers which rise back of the mountains upon the Tibetan plateau, and break northward in stupendous gorges in the Tian Shan mountains. On the other hand, many rivers flow for long distances parallel to the main trend of the plateau, and escape to the plains without crossing any range at right angles. It would be highly instructive if careful maps were made of these rivers, which to-day are in many cases mapped largely by guess. It is not to be expected that such a study should reveal new principles of such far-reaching importance as those to be derived from the study of orography, but much of value can be learned, and the two problems could be readily studied in conjunction.

A more unique problem in reference to rivers is furnished by the streams which appear and disappear in piedmont deposits of silt and gravel. The Niya river, for instance, in Chinese Turkestan, disappears

and reappears three several times, and many other rivers disappear at the base of the mountains and come to light some miles away. In all such cases the quality of the water where the river again comes to light differs more or less from that of the same stream in the mountains. Sometimes the water becomes so saline that it is unfit for use in irrigation; in other cases where the stream does not entirely disappear, it nevertheless loses so much in volume that the sediment which it contains is concentrated, as it were, and the river becomes a stream of liquid mud. Measurements of such rivers ought to be made to discover at what rate they lose volume during different seasons; and the salinity should be tested by taking samples of the water for analysis. The practical importance of this for the people of the lands under consideration is great, for many a time the poor natives of Central Asia have tried to use for irrigation water which was so saline as to ruin the crops.

Aeolian Action.

There is probably no part of the world where aeolian action can be studied to greater advantage than in Chinese Turkestan. In Persia and Trans-Caspia there are also abundant opportunities for the study of the peculiar phenomena due to the erosive action of the wind. An explorer might well spend many years on this problem. Throughout the spring season of high winds in Chinese Turkestan, or during the summer in Eastern Persia, he might make most valuable measurements upon the rate of movement of dunes. Close to one another, in regions such as that of Endere in eastern Turkestan it is possible to find dunes which range from a height of 5 feet to 400 feet. The differences between the motion of the small and the large must be great and instructive. Another interesting problem would be the measurement of the size and shape of grains carried under various conditions. Such studies have been carried on somewhat in Egypt, but we require data from widely separated regions. We ought also to know much more about the relation of sand to vegetation. It is sometimes said that in desert regions the sand of its own volition, so to speak, encroaches upon areas of vegetation and overwhelms them. On the other hand, others assert that this is impossible without some previous change whereby the amount of vegetation has been lessened or a new supply of sand is continually furnished. The question can be solved only by careful observation in many places, especially where rivers flow permanently in the neighbourhood of large deposits of sand. Observations should be made to see how far the rivers, aided by vegetation, are able to make head against the sand, and how far the sand encroaches upon vegetation, even when the plants are kept in full vigour by the rivers.

The rate of aeolian erosion in various kinds of rocks is not, perhaps, so important as the relation of sand to vegetation, but nevertheless it

is of much scientific interest. No one, so far as the writer is aware, has made any extensive quantitative study of the subject. This might readily be done in the desert of Lop by fixing marks which should stand from year to year, and could be visited by one explorer after another.

When alluvial deposits are eroded by the wind, they are divided into coarser and finer portions; the coarser portions remain in the lowlands and form dunes, while the finer portions are carried away hundreds of miles and are deposited as loess. In Chinese Turkestan the process of the deposition of loess can be seen in operation almost daily during the summer, and at frequent intervals throughout the rest of the year. It would be of great value if some explorer could establish a number of observation points along the northern slope of the Kwen Lun mountains, where the deposition of loess is probably as rapid as in any place in the world. At these stations observations on the amount and texture of the materials deposited by the wind could be carried on while other studies were being prosecuted in the region round about. The observer would naturally compare the amount of deposition with the strength and direction of the wind, and he could perhaps estimate whether the conditions of past deposition have been the same as those of the present. Beside this, he might well devote much time to a study of the relation between the amount and kind of vegetation upon the mountain slopes, and the amount of loess deposited. He would probably find that in some areas the wind is now carrying away materials which it deposited only a short time ago, geologically speaking. He might also discover that, in certain areas, deposition has begun very recently, and such areas would probably lie at altitudes higher than those of the major deposits. The correlation of changes in the rate and location of the deposition of loess, on the one hand, and of the changes of climate which have occurred during recent geological times, on the other, would probably lead to important conclusions as to the circulation of the atmosphere during the glacial period.

Terrestrial Magnetism.

Some of the problems to be solved by the geographer require special equipment. Such is the case with the study of terrestrial magnetism. At present, the Carnegie Institute of Washington has in the field several expeditions engaged in magnetic observations in the more remote parts of the Earth. Any explorer who has the time and the ability for such work might add materially to our knowledge of this interesting subject. No place is more likely than Central Asia to afford valuable results. The great mass of Tibet standing above the general surface of the Earth must exert an important magnetic attraction. Turfan, too, lying below the level of the sea in the heart of the greatest continent, is a place where repeated magnetic observations would be of high value.

It is hard to tell what results may spring from the study of magnetism. There are indications that variations in the intensity of magnetic attraction are intimately related to important solar fluctuations. Other lines of evidence have been thought by some observers to indicate that these same solar fluctuations are the cause of the slight climatic fluctuations to which the Earth is subject from year to year. Thus it is possible, though this is mere conjecture, that a study of magnetic variations may lead to far-reaching results in the field of long-range forecasts of weather. At any rate, the subject is of such importance that it ought to receive the attention of well-equipped expeditions to the more remote parts of the world.

Climate and Changes of Climate.

The last physiographic problem with which we shall here deal is climate, the most important factor of physical environment in its effect upon life. The subject naturally falls into three divisions, namely, the climate of geological times, the climate of the historic past, and the climate of the present. The study of the climate of geological times is primarily the work of the geologist; nevertheless, it has so intimate a relation to the work of the geographer that he cannot afford to neglect it. In the first place, the geographer cannot properly understand the effect of climate upon life unless he knows how long the present conditions have prevailed and what sort of conditions preceded them. In the second place, the climatic conditions of the past million years, more or less, are responsible for a vast number of purely geographical features such as the nature of the universal mantle of rock waste which covers all the lands, the forms of terraces, piedmont slopes, alluvial plains, and other features, and the preservation or extinction of basins which have no drainage to the ocean. Moreover, in addition to all this, it is peculiarly fitting that the geographer in Central Asia should engage in some geological work, because he is likely to penetrate to regions where it may be impossible to carry on regular geological surveys for many generations.

The study of the climate of the historic past and of the present is pre-eminently the field of the geographer. An entirely satisfactory knowledge of present conditions cannot, of course, be obtained until meteorological records have been kept for many years. Nevertheless, the fragmentary observations upon winds, temperature, rainfall, and other phenomena made by the traveller in little-known regions are by no means without value. His most important contributions, however, result from careful observations of the effect of specific climatic conditions upon the grouping of plants and animals, and upon the occupations, habits, and character of man—a subject to which reference will again be made in discussing the relation of physiography to life.

Lake Deposits and Old Strands.

Central Asia furnishes the best of opportunities for a study of fluctuations of climate both in geological and historical times. Hitherto the climate of the geological past has been studied mainly in the glaciated regions of North America and Europe, the most notable exception being the investigation of the diminished salt lakes of Bonneville and Lahontan in the western part of the United States. It has been proved that the glacial period was highly complex, consisting of alternate warm or dry and cold or wet periods, but a complete record has never been found in any one place. The advance of a large glacial sheet almost inevitably destroys the evidences of a smaller preceding sheet. In dry regions, however, the records of changes of climate are much more fully preserved. In the first place, there are numerous salt lakes, all of which act as great rain-gauges, expanding or contracting in response to variations in the rainfall or evaporation. The deposits laid down in and around such lakes vary greatly, in accordance with the degree of aridity and the amount of vegetation in the regions whence the waters of the lake are derived. The deposits of one phase cover those of another, and there is little loss by erosion. Thus a complete record is preserved, which can easily be read, provided we know the effect of specific climatic conditions upon the nature of deposits, and provided the buried records can be observed. It is everywhere easy to study the character of present deposits, and in many cases buried records are accessible; for in basins, such as those of Lop and the Lut, the edges of the various deposits have been fairly well exposed by erosion, and in Seyistan movements of the Earth's crust have lifted them up and exposed them to a depth of hundreds of feet.

A geologically minded explorer who could devote several seasons to travelling about the borders of the old lake-beds of Lop, Seyistan, and the Persian Lut could reap an amazing harvest. In a few years he could probably learn almost as much about the occurrence of climatic changes in recent geological times as has been learned in a hundred years in the less favoured regions where glacial studies have been carried on. His chief work would be the making of cross-sections showing the succession of lacustrine clays, swamp deposits, alluvial sand, gravel, salt, and fossiliferous beds in the greatest possible number of old lake-beds. To obtain complete sections he would necessarily travel up and down many waterless valleys, such as the one leading from the mountains of Kuruk Tagh, in eastern Chinese Turkestan, past the ruins of Hedin's Lulan near Altmish Bulak, to Lop-nor. The work would require a fairly large equipment of camels to carry food and water, but the expense need not be great. There are scores of dry valleys on the borders of Lop-nor and the Lut that would yield most valuable results.

Far and away the best opportunities, however, are afforded in Seyistan, where earth-movements, accompanied by volcanic flows, have in some places raised the bed of the lake as much as 500 feet within very recent geological times. Under present conditions it would be no easy task to travel for months in the desert regions surrounding these lakes, and it would be especially difficult to visit the portion of the Seyistan lake-bed which lies in Afghanistan. The very difficulty of the task, however, makes it more attractive.

The traveller who undertakes the somewhat geological task of studying old lake-deposits will inevitably engage in the more strictly geographical work of investigating ancient lake-strands. In both tasks it is essential to make accurate maps and to run lines of levels. The highest strand of Lop-nor lies about 600 feet above the present lake upon the south side, and apparently somewhat lower upon the north. It probably surrounded a lake 300 or 400 miles long from east to west, and at least 100 miles wide from north to south. The strand has been observed at only two or three points, and its actual course elsewhere is purely a matter of speculation. To map all the strands completely, and find whether or not they change in level, would be a most valuable contribution to knowledge. This would involve traversing the Takla Makan and Lop deserts along lines where for a hundred miles at a stretch the explorer would be on new ground. It could only be done in winter, when ice could be carried for weeks or months, and when camels would require the minimum amount of water. At other times the difficulties from heat and from saline water would be almost insuperable. No one should start on such an expedition without a thorough equipment and without previous training in less hazardous exploration. In addition to the mere mapping of the strands, interesting work might be done in studying the vegetation, which seems to have a peculiar quality in the regions once occupied by the lakes. A study of the distribution of plants might possibly in itself be sufficient to determine the extent of some of the successive phases of the lake. The collection of samples of soil, and a study of the porosity of the soil, and of its capacity for storage of water, within and without the limits of the ancient lake might lead to interesting conclusions as to the relation of vegetation to lakes and deserts. Naturally, the explorer who studied the strands of Lop-nor or any of the other lakes, would zigzag more or less from outer to inner strands in order to map all of them at the same time. In Seyistan the work would probably be less difficult than at Lop-nor, so far as physical obstacles are concerned, although the Afghan portion would be very hazardous because of the exclusion of foreigners from Afghan territory. Various other lakes might well be studied in the same manner, and exceptionally interesting results would probably be obtained in the great salt deserts of Eastern Persia. The thorough mapping of the old

strands of the many lakes of Central Asia affords work enough to keep a small corps of men at work for many years.

Changes in Rivers.

Closely related to the problem of the expansion of ancient lakes is that of the former courses of rivers. The Keriya and Niya rivers may serve as examples of a large number of Central Asian streams which die away and utterly disappear not far from the foot of the surrounding mountains. Beyond the farthest point now reached by the water, old channels and lines of vegetation show plainly that these streams once flowed farther into the desert. Again, in Trans-Caspia, as has been already said, the Ungus and the Yuzboi are supposed to be ancient courses by which the Oxus river once flowed past or through the Sea of Aral to the Caspian. A careful mapping of these and of many other old channels would be an arduous but profitable task. The relation of such streams to vegetation, and the changes which take place in the flora of a region when the streams decrease in size, furnish most attractive fields of study for the geographer whose tastes are botanical.

One of the most peculiar phenomena in Chinese Turkestan is the changes which have taken place in the course of the Tarim river. In very recent geological times, but probably long before the advent of man, this stream appears to have flowed nearly straight east from Kashgar, and much to the south of its present course. Later it flowed in approximately its present course as far as long. 87° E., and then, as Hedin discovered, continued eastward, instead of turning to the south-east and south as it now does. At a point near the spring of Altmish Bulak, fully 80 miles north-north-east of its present mouth, it discharged into Lop-nor, then apparently larger than now. Little by little during the last two thousand years the river has been shifting its course back toward the south. Except in the lower portion, however, it still follows a peculiar, peripheral course, much nearer to the north side of the basin than would naturally be expected. The Cherchen river, which also enters Lop-nor, follows a similar peripheral course on the south side of the basin. No one has as yet explained the peculiar course of either stream. It is possible that during one of the inter-glacial epochs Central Asia became so dry that none of its streams reached a terminal lake. Under such circumstances underground water would cause a zone of vegetation to flourish at the foot of the piedmont slopes where the Tarim and Cherchen rivers now flow, just as such a zone now flourishes elsewhere. In course of time the desertward edge of the area of vegetation would become higher than the portion slightly nearer the mountains, because wind-blown sand would accumulate among the reeds and tamarisks on the border, where the moving dunes would be checked by growing plants. Thus the zone of vegetation

would form a shallow trough, with slopes of piedmont gravel on the mountainward side and a low swell of sand and vegetation desertward. When the climate became moister on the advent of a glacial epoch, the rivers would naturally flow farther than before. It would be hard to flow straight out into the sand, but easy to follow the zone of vegetation.

Possibly the chief changes in the Tarim river during the past two thousand years are due to the tendency of the stream to abandon its present peripheral course and flow in the normal fashion near the centre of the basin. The theory here presented is not advanced with the idea that it is conclusive, but merely to illustrate the problem. A sound conclusion must be based upon lines of levels run across the zone of vegetation in various places and out into the desert. It further requires a careful study of the relation of vegetation to the movement of sand. It is possible that the supposed tendency of the Earth's rotation to cause a right-handed deflection of rivers in our hemisphere has something to do with the matter. Altogether the peripheral course of the rivers of Eastern Turkestan presents one of the most interesting among the minor problems of Central Asia.

Having studied the terminal lakes of a river system and the ancient channels in the desert plains, the next step would naturally be an examination of the upper portions of the rivers to see what evidence they present as to climatic conditions in the past. One of the most important lines of evidence is the alluvial terraces which characterize innumerable valleys throughout Central Asia. They form the only land available for agriculture, and hence are of importance economically. Some lie in valleys whose heads have contained glaciers; but in many cases the valleys have never been glaciated in any portion. It appears as if such terraces were due to changes of climate. Apparently in moist periods the mountains were well clothed with vegetation, but in dry periods the vegetation died. Then the soil which had accumulated upon the slopes, and had been held in place by roots, was carried off, for there was nothing now to protect it from erosion. Thus the minor tributaries brought down such heavy loads of sediment that the larger and more slowly moving streams were quite unable to carry it all away. Accordingly, deposition took place, and broad alluvial plains were built up. Sometimes the gravel and sand reach a depth of 500 or 1000 feet. When the mountains were wholly denuded of their rock waste, or when the climate changed so that plants grew once more, the activity of the streams changed; being now no longer heavily loaded, they were able to erode and to cut gorges in the alluvium which they had previously deposited. Thus terraces appear to have been formed. This theory needs to be carefully tested, partly because of its importance in the understanding of such interesting land forms as terraces, and partly because of its practical bearing on the problems of

forestation and deforestation. It would be well worth while to carefully map the terraces of a large number of streams in various parts of Central Asia, and at the same time to ascertain the conditions under which they were deposited, and under which they have been eroded.

Glaciation.

In the lofty valleys near the heads of the main streams of Central Asia, glaciers have given rise to striking phenomena. These too, like the lacustrine strands, abandoned river courses, and alluvial terraces, have never been adequately mapped. Glaciers many times as large as the greatest in the Alps are still unnamed. The mapping of existing glaciers is an interesting matter, but it is even more important to map the moraines, which indicate the extent of ancient glaciation, and which show how many times the ice has advanced in various places and how far. The lakes of the Tibetan and Tian Shan plateaus are known to be very numerous, and it is certain that many of them are due to glacial action. As yet, however, we lack exact data as to the origin, nature, and history of most of them. This problem should be solved in connection with the mapping of ancient moraines. It has often been surmised that some parts of Tibet may at one time have been covered by a small glacial ice-sheet, and no one has as yet disproved this possibility. It seems probable that such local ice-sheets may have existed, but this can be proved only by a careful mapping of the glacial regions of the high plateau.

The preceding discussion of lake strands, ancient river courses, alluvial terraces, and old moraines, centres about the problem of climate. In order to obtain the most trustworthy results, the explorer should determine the relation between these four types of phenomena. In other words, it is essential to discover exactly which strands, which old channels, and which terraces or portions of terraces were formed at the time of certain moraines. To accomplish this the traveller must determine carefully the exact number of the phenomena of each kind, and also their relative size and age. He must endeavour to find terraces which end at the strands of lakes, and others which in their upper portions are associated with moraines. A single instance of such relations will not suffice. It will require long and careful work to find enough instances to prove either that the moraines, terraces, and strands are due to a single climatic cause, or that they are unrelated. In this connection it may be pointed out that the study of terraces affords scope for most careful observation and theorizing. The adjustment of a stream to its grade and velocity and volume is so delicate that very slight changes may produce important results, and the results may differ in different portions of the course of a stream. Thus it is possible that a given dry period may cause deposition in one region and erosion in another, and a certain wet period may do likewise.

Hence, the explorer who attempts to solve the climatic problems of recent geological times in arid regions must be continually upon his guard. He must follow many streams from head to mouth in order to ascertain what changes take place coincidently in various parts of their courses.

Historic Changes of Climate.

The most interesting climatic studies are those which deal with the climate of historic times. Opinion is much divided upon this subject. To many travellers it seems probable that there has been a steady progressive desiccation of Central and Western Asia, and perhaps of other regions, throughout historic times. Other authorities, many of whom are meteorologists, claim that there has been no such change. The climate of the Earth, they say, has been practically uniform for several thousand years; the only changes have been slight and relatively unimportant fluctuations about a mean which is the same now as in the past. Between these two theories lies another. According to it, the climate of to-day averages distinctly warmer and drier than that of two thousand years ago; but the change from the past to the present has taken place in pulsatory fashion. During certain epochs there has been a degree of aridity greater than that of to-day, while other epochs have been characterized by relative moisture. According to those who believe in steady progressive desiccation, or in pulsatory desiccation, the difference between the conditions of civilization in Central Asia two thousand years ago and to-day is due largely to deterioration of climate. Those who believe in pulsatory changes think also that each major pulsation, lasting for a few centuries or a thousand years, as the case may be, has produced important effects upon the distribution of population, and upon historic events, such as wars, migration, and the fall of empires. Believers in the theory of climatic uniformity, on the other hand, naturally deny that climate has been responsible for any such results. Between these three theories choice must be made, and it is incumbent upon geographers to gather the facts which shall lead to a positive conclusion.

In this problem, as in others, mapping plays a highly important part. One of the greatest services which the explorer can render to science is the careful mapping of areas of ancient human occupation and cultivation as compared with present areas. In Trans-Caspia, for instance, numerous ruins lie in places which are to-day uninhabitable. In a still larger number of cases ancient ruins are associated with modern villages, but the ruins indicate a much denser population than to-day. The habitable districts of Trans-Caspia have been fairly well mapped, but there are no good maps showing in detail the areas of ancient civilization. In a limited region it is quite possible that various accidental causes, such as the deflection of rivers or human carelessness, may have caused

a diminution in the area of cultivation without a diminution in the water-supply. Taking the country as a whole, however, such cannot be the case. The Russians to-day have introduced a degree of peace and security which permits the full utilization of all the available water-supply. If it should be found that for the country at large the area of ancient cultivation was notably larger than that of to-day, it would go far toward establishing the fact of an important change of climate. In Persia and in Turkestan the same phenomena exist upon a still larger scale. In those countries not even the areas of modern cultivation have been accurately mapped except in a few cases, and much less the areas formerly utilised.

In all such studies constant and vigilant attention must be given to the date of the ruins under consideration. Again and again we are told that ruins cover an area much larger than that which can be cultivated to-day, but this, it is said, does not indicate that the supply of water was once greater than now. The ruins date from various ages, and those of any one age indicate a population no greater than that of to-day. Hence it is necessary to find, not only how great an area is covered by ruins in a given portion of the desert, but also how far those ruins indicate that the whole area was under cultivation at once. Much help in this problem will be obtained by a study of ruins which lie far from sources of water or from areas now under cultivation. Measurements of rivers and of bodies of water in piedmont plains, such as those suggested in an earlier paragraph, will give data to show how much water could reach a given ruin if the present stream were carried past the oasis of to-day to the more remote sites of habitation occupied in the past. Near Niya, in Chinese Turkestan, the most distant ruins lie in the desert, some 60 miles beyond the present oasis. Apparently, if the water which now irrigates the town of Niya were allowed to flow as far as possible, it would not suffice to reach the ruins, even if none of it were used in the modern oasis; and of course there would be none whatever to support the extensive gardens and fields which once occupied many square miles of what is now pure desert. It is probable that there are many other places where phenomena of this sort exist, and where accurate measurements ought to be made.

Another line of study is the investigation of ruins in connection with lakes and swamps. For instance, tradition relates that the ruins of Sabari lie upon the bottom of the northern portion of Lake Seyistan. The natives say that not many years ago the lake dried up sufficiently to expose the ruins for a month or two. Near the shores of the Caspian sea various ruins lie beneath the present level of the water. Other ruins at Baku and Derbent and elsewhere on the shores of the Caspian show marks which indicate that the water once stood much higher than now. At Issik Kul, in Southern Siberia, among the Tian Shan mountains, ruins are reported to lie beneath the level of the

water, a fact which suggests that the lake once stood lower than now. Far to the east, Stein reports that the westward continuation of the Great Chinese Wall passes marshes which once were lakes. Here one can plainly see upon the wall itself marks indicating the level to which the water rose. There are probably many other cases of ruins either within the present limits of lakes or lying above them and marked by the action of the water. In regard to most there are traditions, and in many cases actual historic records indicate the time to which the ruins belong or during which the lakes rose. By a study of such phenomena it is possible to estimate with a fair degree of accuracy the exact course of the rise and fall of enclosed lakes, and consequently of changes of climate.

In all the desert regions of Central and Western Asia there are numerous traditions or records of old roads which are not now used. In the days of the glory of Rome, great trade routes passed through Afghanistan and Persia in places where no commercial caravan thinks of going to-day. At the dawn of history vast caravans, carrying the trade of China to the west, followed a route which is to-day impracticable because of the absence of water and fodder. In like manner old roads once crossed the sands of the Takla Makan desert, the vast waste places of Arabia, and the dry stony expanse of the Syrian desert. Some of the roads have been abandoned for one cause, and some perhaps for another. It would be an interesting matter for an explorer to set out with the purpose of following as many of these old roads as possible. He could then determine how far they are to-day practicable, and how far a change in physical conditions has rendered them no longer passable for commercial caravans.

In studying the problem of climate, the effect upon plants and animals is almost as interesting as the effect upon man. In the Kuruk Tagh of Chinese Turkestan, near Turfan, the piedmont slopes of gravel among the arid mountains are marked by old game paths leading to springs now dry. At some time, so recent that the paths are still preserved, the springs must have contained a relatively permanent supply of water, although now they contain water so rarely that animals visit them only at long intervals. Here and there shelters for hunters stand beside the desiccated springs, showing that wild animals frequented the place since the coming of man. It is highly probable that other evidences of this kind might be found, and that a study of the distribution of animal species in the past as compared with the present might lead to interesting results. This is one of the many problems which have as yet received practically no attention. It would hardly be wise to undertake an expedition whose chief purpose should be such studies, but the geographer who has the matter in mind is apt to pick up facts which may be of much importance when interpreted in connection with what is learned by others.

A study of vegetation and its relation to climate is sure to yield large results. Deforestation is one of the subjects of greatest importance in all the drier portions of the world. We are told, sometimes, that the cutting off of forests causes important changes in rainfall, but meteorologists almost universally deny this. We are further told that the cutting off of forests has been one of the great causes of the fall of nations and the decay of civilization in various parts of Asia. Numerous traditions and historic records unquestionably indicate the former presence of forests in places where none now exist. This subject should be studied by an explorer trained in forestry and in climatology. He should go to the areas where historic records prove the former existence of forests, and should there examine carefully the possibilities of forestation at present. He should collect data as to the depth of soil and especially as to the occurrence of summer rains, which are the most important of all factors in determining the location of forests. In addition to this, he should study especially those areas where trees, or other forms of vegetation, have died off and disappeared without the intervention of human agency. Such areas are found especially in Chinese Turkestan, where hundreds and even thousands of square miles of the zone of vegetation are studded with the gaunt skeletons of poplars, which have died from lack of water, and with great tamarisk mounds, whose peculiar growth is apparently due to the same cause. Elsewhere, for mile after mile, the stalks of dead reeds cover the ground in profusion, showing that where now all is dead and barren, vast beds of waving reeds once stretched green and gold to the horizon. Again, in other regions, traces of forests are reported high among the mountains beyond the present tree-line. Here and there traces of ancient cultivation and of fruit trees and poplars are found in places like Endereh, in Chinese Turkestan, where to-day the water, which must have been used for irrigation, is so saline as to prevent the growth of such trees. Apparently such regions were once decidedly moister than now, and a change in climate has increased the amount of evaporation, thus causing the water to become more concentrated, and hence more saline and unfit for agriculture. A journey through Asia for the express purpose of studying the relation of forests and of vegetation to topography and rainfall, and of investigating the changes which have occurred in vegetation during historic times, would be as fruitful as a journey well could be. It requires, however, a man who is not only a geographer in the sense of being able to travel and make maps, but also a man who has a thorough training in the ecological or geographical branch of botany.

Before leaving the subject of historic changes of climate, attention should be called to the necessity of systematic search, not only for evidences that the precipitation of the past was more abundant or the temperature lower than at present, but also for evidences of less

precipitation or higher temperature then than now. For instance, near the lake of Son Kul, in the Tian Shan mountains, there are a number of old canals evidently designed for irrigation, but lying in a region where to-day agriculture is utterly impossible. Snow falls almost every month in the year, and the brooks are skimmed with ice in mid-July. Nevertheless, at some time, crops appear to have been grown here. On the other side of the world, in Mexico, ruins of villages are reported in places which are to-day so cold that agriculture is impossible. It is possible that in Tibet, or in the high mountains of Tian Shan, or in the Altai other such places exist. If they do, they point strongly to an historic epoch when the climate was distinctly warmer than at present.

In all studies of historical as well as of geological changes of climate the problem of correlation is fundamental. Just so far as possible, each phenomenon must be accurately dated, and its relation to other phenomena must be investigated. For instance, the structures which lie below the level of the Caspian sea, and are now submerged, appear to be of two ages and to indicate two different periods of exceptional aridity. It ought to be possible to determine whether they are contemporaneous with the reported ruins in the lake of Seyistan and with the canals of Son Kul.

Effect of Pronounced Environment upon Man.

To the majority of mankind the most interesting portion of geography is the ontographic portion, dealing with the relation to physical environment to life. An understanding of the influence of environment upon human habits and character can be obtained most easily by the study of primitive people, living under extreme conditions of any type, but especially under extreme conditions of either climate or topography. Hence the nomadic inhabitants of deserts, the dwellers in oases, or the people of lofty secluded mountains furnish peculiarly profitable subjects of study. We find that in such cases peculiar habits and customs are generally localized in small areas. For instance, a certain tribe in the Sahara desert is noted for its honesty, never stealing as its neighbours do. The explanation is said to be that the tribe lives in the sand, where it is very easy to follow tracks; hence a thief is almost sure to be detected, and honesty has become the rule. Again, on the famous Karakoram route from India to Chinese Turkestan, it is a point of honour with the native travellers never to steal any articles found upon the road. Time and again caravans on the vast uninhabited plateau, at an elevation of from 15,000 to 18,000 feet, are overtaken by storms or are incapacitated by the death of the pack-animals. They leave their bales of goods beside the road in full view, confident that no one will touch them, and that they can return and get them the following season. This peculiar form of honesty has perhaps grown up because each man who travels

this baleful route is liable to suffer loss himself, and thus there has arisen a feeling of sympathy for the losses of others. A good example of the effect of different kinds of environment is seen in the habits of various people as to so simple a process as bread-making. The Turkoman of the Transcaspian desert chooses a sandy spot for his fire, and when the sand is hot brushes away the coals, smooths off the ground, and spreads the dough upon it. Then he pokes the coals mingled with heated sand back upon the dough, and leaves the bread to bake. The Afghan, living among stony wastes, oftentimes heats a stone in the fire, pulls it out, covers it with dough, and throws it in again. The dweller in the smooth alluvial plains of Persia makes an oven of mud and heats it with bushes. In all these cases the controlling factor of environment is climate. It is the low temperature of the Karakoram route which makes it so difficult. It is the long prevalence of aridity which has given rise to the sandy deserts of Transcaspia and the rocky piedmont slopes of Afghanistan. Topography, too, is highly important, for the altitude of the Karakoram plateau causes its low temperature, and the flatness of the Persian plains causes them to consist of fine clay rather than sand or gravel.

Another type of human response to geographical environment is found in architecture. For instance, in Eastern Persia, and in other regions where the climate is dry and where the mountains are so low that they furnish practically no water for irrigation in summer, it is impossible to raise trees, which require moisture during a long season. Hence the inhabitants have adapted themselves to their surroundings by learning to build houses composed entirely of adobe bricks, and having domed roofs. On the other hand, at the foot of the Kwen Lun mountains in the zone of vegetation, in Chinese Turkestan, there is no more rain than in Persia. The mountains to the south, however, are so high as to be covered with snow all the year. This gives rise to great floods which persist well into the summer; hence, even in the latter part of the season, there is water enough to foster the growth of trees. Therefore the Chanto of Chinese Turkestan uses wood abundantly in his house, and employs clay merely for plaster, as a rule. Sometimes, indeed, along the lower courses of the rivers, he cannot use mud even for plaster. The salinity of the soil is so great that the clay, even though of fine texture, will not stick together; hence it is impossible to make adobe bricks or to employ it as plaster to stick in the chinks between the logs. The Chanto can keep the cold winter air out of his house only by the poor expedient of putting layers of tamarisk twigs or of reeds between an outer and an inner set of roughly hewn poplar-beams. Hundreds of other examples of the localization of special habits, or of special modes of life, because of peculiar climatic or topographic conditions might be cited. Many such are recorded in books of travel; but in the majority of cases, while the peculiar habit is noted, the cause is not

explained. The geographer whose tastes are ethnological has before him an almost unlimited and a most fascinating field.

Migrations.

The readiness with which mankind, especially in primitive conditions, moves from place to place in response to climatic conditions is extraordinary. Year after year outlying areas on the edges of the oases of Central Asia are abandoned or reclaimed in response to seasonal variations in rainfall. Maps of these regions at intervals of a few years would be an interesting means of obtaining a rough record of rainfall in places where no instrumental records can be kept. Annual variations of precipitation sometimes cause movements of population on a somewhat large scale. During the dry years of the seventies various tribes of Dungans and others changed their habitat because of scarcity of fodder for their animals. In some cases they travelled hundreds of miles, and came into warlike conflict with the people along their route. The number of such minor movements must be great, and careful inquiry would probably enable us to correlate them with climatic cycles such as the thirty-five-year periods of Brückner. There is probably no geographical problem more important than a detailed study of the effect of cyclical variations of climate. In certain regions the rainfall of the moist portion of a Brückner cycle is from 50 to 100 per cent. greater than that of the dry portion. Such a difference may cause the limits of profitable wheat-raising, for example, to shift through three or four degrees of either latitude or longitude. In every generation hundreds of thousands and probably millions of the Earth's human occupants are plunged into distress because of ignorance of the fact of climatic cycles. Every bit of information which the traveller can gather on this subject has a direct practical application.

In connection with movements of population, one of the subjects which presents a broad field of study is the routes of seasonal migrations and raids. Data as to these are easily obtained, for the nomads are always ready to tell where they spend the winter, where they move in spring, and where they go in summer. The geographer's part, here as in so many other cases, is first to map the migrations. Then he is prepared to see what peculiar characteristics they possess, and why special routes are followed. An interesting problem would be to see what relation exists between the summer and winter camping-grounds. Do people who live during the summer in lofty plateaus so cold that nothing will grow except grass, move to any special type of region in the winter, or are their winter camps determined merely by accidental considerations, such as proximity? Among tribes such as the Afghans, who are in the habit of making raids, it would be profitable to ascertain exactly the seasons at which raids are most common, and the causes. This, like many other subjects, is one upon which

more or less has been written, but it has never been studied systematically. Among the Arabs the months of May and early June are the great time for long raids. The reason is that at that time the mother camels can be taken away without injury to the young, and their milk can be used to support not only the raiders, but the fleet mares needed for the final dash against the enemy. Similar customs, due to the changing seasons, must exist in many places.

Distribution of Modes of Human Life.

The last geographical problem which we shall consider is the distribution of various modes of human life. In Central Asia, because of the contrasts due to the aridity and great relief, we find different modes of life in interesting and suggestive juxtaposition. One of the tasks to be accomplished by the explorer in Central Asia is a mapping of the location of each type, and a discussion of the reasons for its location. Most parts of the world are divided more or less distinctly into linear zones running parallel to the main mountain axes. This is especially true in dry regions. The first zone consists, of course, of mountains or plateaus; then come slopes of piedmont gravel, and beyond these a zone of vegetation or a strip where rivers spread out and oases are located. Between or beyond the oases the sandy desert begins, interrupted sometimes by rough tracts where deposits of clay are being dissected by the wind, and sometimes by bands of vegetation along streams which are of such size that they have not disappeared in the zone of piedmont gravel. Finally, beyond the sand one finds a terminal lake located in the lowest part of a basin and surrounded sometimes by great stretches of salt, and sometimes by vast swamps full of reeds. Each of the zones has its own peculiar people. Among the mountains, provided there are plateaus or grassy slopes, the population consists of nomads, such as the Kirghiz or the Kurds. In the valleys village-dwellers of the same races cultivate a few scanty fields for half their living, and for the rest drive their flocks into the mountains and lead a semi-nomadic life. Hardy people and bold they usually are, and prone to plunder their richer neighbours. At the foot of the mountains the zone of piedmont gravel is sometimes habitable, but never rich, and often utter desert. If it has any inhabitants, they are apt to be nomads or else poor villagers, who dig tunnels into the gravel and thereby extract a scanty supply of water from its depths. The wealth of the country is concentrated in the oases of the zone of vegetation. Oftentimes the zone is by no means continuous, and is very irregular, its distance from the mountains depending upon the size of the rivers. Nevertheless, it has a genuine existence in almost every arid region. Life in its shelter is relatively easy; there is usually slight danger even from nomadic raiders; and there is little to tempt the inhabitants away from their pleasant oases. Hence there develops not only a type of civil

organization entirely different from that of desert or mountain tribes, but also a weaker or softer type of character. Out in the sand life once more becomes hard, and there are few inhabitants—nomads, depending chiefly upon camels and sheep. Finally, in the swamps around the lakes the most peculiar of all the races are located—the fowlers of Seyistan, depending for a livelihood upon the birds which they catch in nets; or the Lopliks of Chinese Turkestan, depending largely upon fish.

To map the various zones of Central Asia and the distribution of the different modes of life is one of the most fruitful and fascinating tasks of the geographer. When he has done so he is ready to discuss the causes which govern the distribution, not only of man's varied modes of life, his occupations, and his habits in respect to physical matters, but also of mental and moral characteristics. This leads directly to one of the most profound and fundamental of all subjects of study, the great problem of how far geographical environment is the controlling factor in human life, and how far other causes operate. The solution of this problem is not, perhaps, the province of the geographer; but it is his duty to prepare the facts which shall lead to its solution. Having mapped the distribution of various modes of life, he may well supplement his work by making anthropological measurements like those so well made by Stein, and by a study of the distribution of races, languages, and religions. He is then prepared to make comparison between the inhabitants of similar regions who differ in race, religion, or language. Knowing accurately the physical conditions of life, and being familiar with the customs or manners of the inhabitants, he can judge how far uniformity of physical conditions induces uniformity of life.

The number of problems which await the geographer in Central Asia is almost infinite. It has been possible in this article to touch upon only a few of them. Exploration, in the common sense of mapping new areas, is to-day relatively unimportant. Exploration for the purpose of solving the great problems of the structure and form of the Earth's surface, the distribution of physical types, and the relation of physical environment to the grouping and character of living organisms presents a field whose possibilities are boundless.

THE PRESENT TREND OF GEOGRAPHY IN THE UNITED STATES.

By R. H. WHITBECK, University of Wisconsin, Madison.

Suppose we begin with the decade of 1880 to 1890. There were then a half-dozen American text-books in use, more or less alike. They consisted of a number of unconnected chapters; on astronomy, on geology, on meteorology, on a phase of zoology, a chapter describing the main physical features of the continents, a treatment of magnetism, of glaciers, of the distribution of the races of men, and some

other topics. Then, as now, the prevailing character of the text-books determined the nature of the subject-matter which was taught in the schools.

In looking over those earlier text-books, one is impressed with this fact: in their make-up there was no unifying principle. Each separate chapter was like a separate monograph. The books might almost have been a collection of chapters borrowed bodily from ten or twelve text-books on the various sciences, with a limited amount of strictly geographical material added. The study was not a real science. Perhaps it was more truly an introduction to the general field of science. When well taught it was interesting, informing, and as useful as most school studies are, but it was almost wholly a book study and a memory study. Few, if any, teachers considered physical geography as a laboratory science at all in those days.

Twenty years ago some leaders of thought in the field of earth science began to voice mild protests against this kind of physical geography. A reform movement started, and in 1893 took shape in the epoch-making report of the Committee of Ten, or rather, the report of the sub-committee known as the Geography Conference. The recommendations of this committee were so manifestly sane that they appealed to the thoughtful teachers in high schools and colleges the country over. This report, among other things, recommended a closer delimiting of the field of physical geography, particularly emphasizing the treatment of physiographic processes, and of the origin, development, and classification of land-forms. Field and laboratory work were called for, and it was recommended that the subject be given an entire year of time, preferably the first year of the high school course. (A fourth year elective course was also recommended.)

Fortunately this report was soon followed by a very acceptable text-book constructed on the lines laid down by the committee. In a case such as we are considering a report of a committee, no matter how sane and convincing, will bear little fruit in the field of actual teaching unless the teachers can have a text-book embodying the principles and the subject-matter recommended by that report. The success of this first modern American physical geography brought forth other books of the same general character, and by 1903 the new type of physical geography was being generally taught. We have been at it long enough to give it a fair trial. We have a large and varied collection of laboratory manuals. We have had much discussion of the subject in educational gatherings. The *Journal of Geography* has collected and published opinions of a considerable number of interested men, who have set forth very positively their views. We have had a round-table discussion among the foremost geographers of the country at the Baltimore meeting of the Association of American Geographers in December, 1908, followed by the appointment by that body of a committee to make a report upon Secondary School Geography. We had the appointment by the National Education Association at the Cleveland meeting in 1908 of a similar committee, whose report was made at Denver last summer. All this indicates the widespread feeling of unrest among teachers of geography.

To what, then, is this feeling of unrest due? I believe that Prof. Dodge, editor of the *Journal of Geography*, felt the pulse of the movement in the questions which he published in March, 1908, and the answers to which were published in that issue and the April number of the same year. The general criticism of physical geography as taught in high schools may be summarized somewhat as follows:—

First, it is too closely restricted to the description and classification of land-forms, is somewhat too geological, and has a tendency to include unusual and unimportant land-forms and water-forms in order that classifications may be complete. For example, it is not uncommon in a text-book to find six, eight, or ten different kinds of lakes or plains or mountains described, even though, perhaps, one third of these are relatively rare forms.

Second, there is dissatisfaction with the kind of laboratory work which is being done, and with the results of that laboratory work.

Third, there is a growing belief that geography in secondary schools should not be simply *physical* geography, but should be based upon a preliminary study of physical geography, followed by a study of geography in its broader aspects; that is, geography in which the human element is more conspicuous.

I wish to present six of the eight questions which were sent out by the *Journal of Geography* in the early part of 1908, together with a *résumé* of the answers received. These answers will indicate something of the trend of opinion. The group of men who submitted these answers is a very thoroughly representative group, and their opinions are entitled to as much weight as the opinions of any group of men that could be secured in this country. The questions were as follows:—

(1) Do you believe that secondary school geography for students not preparing to enter college should be restricted to physical geography as outlined in the modern text-books?

Nineteen persons answered the question. Every one said "No."

(2) Do you favour a continuation and development of the modern practice of emphasizing the detailed, sympathetic classification of land-forms?

Nine said, unqualifiedly, "No." Three said "No," with some qualification. Four said "Yes," with some qualification.

(3) Do you believe that secondary school geography would be equally valuable as a subject for pupils not proposing to enter college, if it included more of a study of selected regions of the world?

Eight answered "Yes," without qualification; six, "Yes," with qualification, and three, "No," with qualification.

(4) Could a course along these lines (the study of selected regions of the world) be as disciplinary and strong as the present generally followed course?

Ten said "Yes," and four others, "Yes," with certain qualification. Two said "No," with qualification.

(5) Should commercial geography be included in non-technical high schools? If so, should it be as a separate course or as an important phase of some systematic regional treatment?

Of those who answered, eight favoured the introduction of some commercial geography into the high school course, and nine objected to commercial geography, at least as a separate study in non-technical high schools.

(6) Is the content of the modern course too much influenced by our belief in a necessity of laboratory treatment?

On this question opinions were equally divided. Seven answered in the affirmative, with some qualification, and seven in the negative, with some qualification.

What, then, do these opinions indicate?

(1) That high school geography should not be restricted to the subject-matter as outlined in the modern American text-books.

(2) That we should not continue the modern American practice of emphasizing the detailed, systematic classification of land-forms.

(3) That the introduction of the study of selected regions of the world into secondary school geography is desirable.

(4) That such a course could be as disciplinary and as strong as the present generally followed course.

Upon these four points the agreement was so complete as to be convincing; but on the question of the proper place of commercial geography and the value of laboratory exercises there was a division of opinion. Certainly, then, the trend

of opinion as indicated by this investigation is clear. It is toward the humanising of the study.

At the meeting of the Association of American Geographers in Baltimore in December, 1908, there was a round-table discussion on secondary school geography. At that meeting were fifty or more representative geographers from leading colleges, and a few of the normal and high schools. There was unusual harmony of opinion upon the essential points raised in this discussion, and the opinions tended in the same direction as those collected and published by the *Journal of Geography*, i.e., that physical geography, as at present taught, needs modification in the direction of a larger emphasis upon the life side. No particular efforts were made to secure expressions of opinion as to just how this larger emphasis of the human side should be attained. This is a detail which has yet to be worked out; but the general trend undoubtedly is toward a study of selected regions of the world.

At the meeting of the National Education Association in Cleveland in 1908, the science section authorized the appointment of a committee of seven to investigate and report upon secondary school geography. That report was read by Prof. J. F. Chamberlain, the chairman, in the Denver meeting last July, and was published in the September, 1907, number of the *Journal of Geography*. The men composing this committee were for the most part high school and normal school teachers. Their report recommends changes in the same direction as those indicated in the round-table discussion at Baltimore, and in the symposium in the *Journal of Geography* in 1908.

Here, then, are three different means of judging the present trend of secondary school geography. The trend is toward the humanising of the study. In the recent National Education Association report, the committee says, "The course, as at present organized, places too much emphasis upon the detailed study and classification of land-forms, and too little upon human response to these forms." "It cannot give the student that knowledge of the regions and peoples of the world which intelligent participation in the affairs of life requires." This report recommends a half-year of study of physical geography, followed by the study of regional geography.

There are two other directions in which we may expect to find light. One is in the character of the text-books, which appear from time to time, and the other in the courses which are being added to college curricula. As regards text-books, no distinct trend is especially noticeable, but rather the prophecy of a trend. For instance, this prophecy is evident in the increased attention given to geographical influence in human affairs in Prof. Tarr's last book on physical geography, as compared with his earlier books, the insertion of chapters on the importance of waterways to people, the influence and importance of mountains, the importance of plains in history, and other similar chapters in Fairbank's recent book; and in the insertion of a chapter on the effects of physiography on plants and animals in Prof. Salisbury's 'Briefer Course in Physical Geography.' All these are indicative of an increased interest in the responses which life makes to its physiographic surroundings. Naturally this movement toward a larger emphasis upon the human side is not conspicuous in the text-books, inasmuch as the movement is yet very young. I am convinced that as soon as the movement takes definite shape, text-books will appear in which there will be an increased attention given to the human or life side of the study.

As to college courses, here the same tendency is noticeable. Fifteen years ago there were but few American colleges that gave courses in even *physical* geography. For instance, I find in the catalogues of Wisconsin, Cornell, Chicago, Yale, and Harvard that only eight courses in all in physical geography were offered, and no

course in any human phase of geography. At the present time, Cornell offers at least two courses in geography, Harvard three, Yale five, Wisconsin six, and Chicago eleven. These five universities now offer a total of at least twenty-seven courses in geography, in addition to eighteen courses in physical geography. This is a rather remarkable growth when we consider that most of the courses in geography (not physical geography) have been added in the last five years. The courses offered by Chicago University are perhaps the most striking: Commercial Geography, Influence of Geography on American History, Economic Geography of North America, Economic Geography of Europe, Advanced Commercial Geography, Economic Geography of the Tropical Countries, Principles of Geography, the Geographic Problems of the Orient, Principles of Anthropo-geography, Geographic Influences in the History of New England, Geographic Influences in the History of the Interior. Such an array of purely geographical courses recently added to the courses of instruction in one of our great universities indicates a noteworthy trend of interest toward the study of man in his geographical surroundings.

Even regional geography is now considered as a topic worthy of university treatment. Most of the larger universities give courses in the Physiography of North America and of Europe. Yale gives courses in the Geography of North America, the Geography of South America, the Geography of Asia, and Geographical Controls in History. The University of Wisconsin gives courses in the Physiography of the United States, the Geography of North America, the Geography of Europe, the Geography of Wisconsin, and the Geography of the World.

Here, then, are five different sources from which we may gather conclusions as to the present trend of geography in the United States.

(1) The symposium carried on by the *Journal of Geography* in 1909.
(2) The round table of geography in Baltimore in December, 1908.
(3) The report of the N.E.A. committee in Denver in July, 1909.
(4) The evidences of more recently published text-books.
(5) The growth of geography courses in our universities.*

The fact that from all these different directions we gather the same impression as to the present trend of geography seems convincing. Taking it for granted, then, that the present trend is toward the larger emphasis upon the life relations in geography, the question next arises, in just what form shall they be presented in the high schools? We must not forget that most of the high school geography is taught in the first year to girls who are still playing with dolls and to boys who still wear knee-trousers; second, that the teachers in all but the larger high schools are not specially trained to teach the subject. In several tours of high school inspection, both in the east and west, I find that classes in physical geography are very commonly distributed among the various teachers of the faculty, whose schedules will best permit of their taking such classes. In two cases at least I have found the teacher of stenography teaching physical geography. It is my impression that not 10 per cent. of the teachers of physical geography in the smaller high schools have had special preparation for the teaching of this subject.

Recognizing, then, the immaturity of the pupils and the lack of special preparation among teachers, it will be necessary that the subject-matter of high school geography shall be (1) simple enough for immature pupils, (2) so carefully worked out in the text-books that untrained teachers can handle it.

At present the movement has not gone far enough to clearly indicate just how

* Since this paper was written, a special committee of the Association of American Geographers made its report in Boston. This report recommends changes in exactly the same direction.

this increased emphasis on the human side of geography shall be secured. Two suggestions have been advanced. The first is that the main subjects now presented in physical geography shall be retained, but that the less important subjects shall either be omitted or treated briefly. One of the modern text-books in geography describes at some length young rivers, mature rivers, old rivers, graded rivers, revived rivers, antecedent rivers, engrafted rivers, and dismembered rivers. Another treats in some detail playa lakes, lakes formed by lava dams, crater lakes, glacial lakes, delta basins and lakes, coastal lagoons, land slide lakes, coulee lakes, and lakes without outlets. As I understand the proposed change, it would be to omit entirely two or three or more of these rather uncommon types of rivers or lakes; secondly, to omit some of the details which are now taught about the remaining types of lakes and rivers. The space thus saved would be devoted—in the case of rivers, for instance—to a discussion of the influence of rivers upon transportation, the influence of river valleys in directing the course of railroads, the influence of flood plains upon agriculture, the influence of waterfalls upon manufacturing, the influence of rivers on irrigation, the importance of valleys as the seats of population, wealth, and culture both in past times and at the present time. In the case of mountains, a briefer discussion of the various types of mountains, their origin and geological structure, than is now customary, with an increased attention to the influences which mountains exert as national boundary-lines; as barriers to the spread of plants, animals, and men to the migration of peoples and military movements; as barriers which separate types of men, and thus lead to the development of different ideas; the relation of mountains to forests and to mining; the influence of mountains upon travel and transportation, upon trade routes, especially railway lines, their influence in preserving among their inhabitants ancient customs, laws, and languages, as seen among the Welsh mountaineers, the Basques of the Pyrenees, the inhabitants of the Caucasus, and as seen among our own southern mountaineers. This method of treatment would not give any particular instruction in regional geography, but would be rather a study of physical geography and of geographical influences upon life.

The other method of treatment which has been advocated, and which was recommended by the N.E.A. Committee, whose report was read in Denver last summer, is as follows: To give about one-half of the year to the study of physical geography as such, and to give the other half to the study of regional geography in which is made the application of the principles already taught in physical geography. This method would be similar to that used in the upper grades of elementary schools, with the difference that the pupils are somewhat more mature, and therefore the subject would be treated from a more mature point of view. Those who favour this study of regional geography are not wholly agreed as to what the regional units ought to be. Some believe that a relatively small unit like the state, or at any rate, not larger than the United States, should be taken. The N.E.A. Committee recommended the study of North America and Europe. This is a matter yet to be worked out, and as soon as we are agreed that about one-half of the time given to high school geography should be given to the human side of geography, or to regional geography, we shall then be in a position to determine how best to present this second half of the study.

It would be unfair to drop this discussion without a consideration of the possible dangers which lie ahead. It is a well-known fact that movements of this kind are often like those of a pendulum, swinging first too far in one direction and then too far in the other. The pendulum has recently swung too far toward the description and classification of land-forms. Recognising the error in this, we are quite likely to go too far in the other direction. As I view the matter, the dangers are likely to lie in the following directions:—

(1) In a tendency to ascribe to geographical influences many results which have arisen from not only geographical influences, but from historical, racial, or even accidental influences. Already it is noticeable among writers who are enthusiastic over geographical influences, that there is a tendency to give undue weight to them.

(2) There is danger of too hasty generalisations, without enough specific examples to warrant the generalisation.

(3) There is danger of a vagueness and indefiniteness in the treatment of geographical influences in human affairs because of the very largeness of the subject. When an author of a high school text-book attempts to treat these influences in the limited space at his disposal, vagueness is almost unavoidable. If the new type of geography shall come to be taught in the schools, there will be need of taking up only a limited number of geographical influences, and of working these out in detail, rather than taking up a large number of influences which necessarily can receive scarcely more than mention.

(4) The teachers who will be called upon to teach this new type of geography will, for the most part, be themselves inexperienced and unprepared. They will not have had similar courses in normal schools or colleges. This must be borne in mind in our consideration of whether or not the present trend is likely to lead to better results.

Unmistakably the trend is in the direction which has been pointed out. Undoubtedly new text-books constructed along these lines will be forthcoming. It will be unfortunate if, in our zeal for humanized geography, we should advance too rapidly, and thus, perhaps, bring into disrepute the very movement which we believe ought to result in a distinct educational gain.

Personally, I am strongly favourable to the humanizing of high school geography. I hope to see the movement gain headway as fast as it reasonably can. But I do not anticipate that the movement will go forward without mistakes and without set-backs. But, to me, the humanized course is so much richer in content, so much more valuable in giving culture, and so much more liberalizing in its influence, that I cannot resist the conviction that we shall be educationally benefited by such a course in the high schools if it can be judiciously handled.

EGYPTIAN IRRIGATION.*

By Colonel Sir COLIN C. SCOTT MONCRIEFF, K.C.M.G., K.C.S.I.

IT is generally admitted that when the English occupation of Egypt commenced in 1883, there was no branch of the administration in a more corrupt and inefficient condition than that on which the very life of the country depended, the irrigation. In no department has there been a greater improvement. Money has been no doubt lavishly spent, but it has been spent with judgment and ability, and it yields a magnificent revenue. When one sees the great monuments of Egyptian skill in classical times, it seems strange that a nation capable of designing and erecting such buildings apparently never thought of controlling the river on which they depended. Nor was it until early in the last century that, acting on the advice of competent French engineers, a serious effort was made to throw a dam across the two branches of the river at the apex of the delta. It was boldly designed, and in some respects well executed, but M. Mougel, its engineer, received little support or encouragement. A bad fracture took place in 1867, and it was not until the arrival of the English

* Report on the Irrigation Departments of Egypt and the Sudan for the year 1908

engineers seventeen years after that any effort was made to repair the fracture or complete the work. The finances of Egypt were then in a deplorable state, and the country owes it to Lord Cromer's force of character and just appreciation of its wants, that he insisted on a million sterling being laid aside for the improvements of the irrigation works. With this sum at their disposal the course was clear for the English engineers, and the first work to be taken in hand was the completion and strengthening of Mougel's barrage. Until this was accomplished there was nothing to prevent about 70 per cent. of the volume of the Nile flowing out to the sea, just at the time it was most in demand for the summer irrigation of the cotton crop. Once it was completed, and the water was held up 12 feet above the barrage, the supply of the river was so effectively diverted into the canals and thence on to the fields, that one might often see children and donkeys fording the river down-stream of the barrage instead of paying a halfpenny toll for crossing the bridge.

But this was not enough. Mougel's barrage raised and diverted the river during low Nile, but did nothing to store the great volume that rolled out to the sea during Nile flood, a volume more than thirty times as great as the discharge of the low Nile. It was not till some twelve years after the British occupation that the finances of Egypt allowed this great subject to be tackled, and the Aswan dam was constructed, ponding up the river 75 feet, and creating a lake in Nubia nearly 200 miles long. Mougel's barrage only served the purposes of the Delta. South of Cairo the only irrigation effected was by means of the flood waters. With exception of one important canal in Middle Egypt, there was no water available for the cotton and sugar-cane crop. The great dam at Aswan supplied perennial water for Middle Egypt, and to divert it from the river on to the fields a dam was constructed at Assiut, similar to Mougel's barrage.

But the thirst of the land exceeded even this great water-supply. South of Assiut there was still only flood irrigation, and there was no water available to do more. It was resolved, therefore, to raise the Aswan dam 23 feet, thereby increasing by two and a quarter times the volume stored. This great work should be finished in 1912, and will supply perennial water for all the Nile valley north of Aswan.

In order to control the discharge south of Assiut, another dam has just been completed at Isna, 98 miles north of Aswan. The construction of this dam reflects the greatest credit on the engineers and contractors who carried it out. It consists of 120 openings, each 5 metres wide. The width of flooring (that is, the width of the river) is 2820 feet. The work was completed in less than three years, at a cost of about a million sterling. It will supply perennial irrigation to about 100,000 acres on the west bank, and 80,000 acres on the east bank, of the Nile.

But the outlay on the conversion of flood to perennial irrigation is far from being finished with the completion of the Assiut and Isna dams. It has been necessary to construct a costly network of new canals to carry the water to every part of the Nile valley. The new main canal on the west bank from the Isna dam will be 56 miles long, and on the eastern bank 45 miles. Including bridges, sluices, and other masonry works, there will be an outlay of about £500,000.

In Middle Egypt, the irrigation of which depends on the Assiut dam, the process of converting flood into perennial irrigation has been going on for some time. Up to the end of 1908, an area of 370,000 acres had been converted at a cost of £3,600,000. The increased rental value of the land is about £5 per acre, and the sale value about £50 per acre. To complete the conversion works in the Ghish province will require an outlay of about £668,000, and the value of the land will be enhanced in about the same proportion as the above.

In 1883 there were no roads in Egypt outside of the towns, and it was impossible

to drive a cart from Alexandria to Cairo. Camel carriage is always difficult in moist irrigated land. Navigation on the numerous canals was generally obstructed in order to increase the revenue of the State railway, which was hypothecated to the national debt, and there were heavy tolls imposed on the boat traffic on the river. Now the Nile is free of tolls. There is an excellent system of agricultural roads throughout the country, and more than 100 miles were added to it this last year. On some of these roads light railways are now being constructed.

When irrigation in Egypt fell into English hands, the engineers soon recognised that the task of carrying surplus water off the land would be as difficult as that of carrying it on to the land, and the more the irrigation increased the more was the need for drainage. This was largely due to the very faulty alignment of the old canals, which repeatedly crossed the drainage outfalls, and in the delta to the extreme flatness of the country and the difficulty of obtaining a satisfactory outfall into the tideless Mediterranean. Much of the province of Behera is below the sea-level, and everywhere along the sea-face there were extensive swamps. Inland, also, there were large areas of sodden and water-logged country which once had been fertile.

Early measures were taken to remedy this evil, but unfortunately the million Loan was ear-marked for irrigation and not for drainage works, and it was not easy to find money for these last. The subject, however, was not neglected, and many hundreds of miles of drainage channels, some with beds of not less than 60 feet wide, have been constructed. In the year 1908 there was an outlay of about £145,000 on excavating new drains and in maintaining and clearing existing ones. But more is necessary. It is said in this report, "Notwithstanding the increased expenditure, it cannot be said that the drainage is satisfactory, although improvement has certainly been made in recent years. Complaints are frequently made that the drains are full of water, and not working properly." The beds become choked with weeds, and the slope of the channels is insufficient. The only remedy for this must be the erection of powerful steam-pumps along the seaboard. There are some already, but more are required. Artificial drainage by means of pumps is a very costly process, as they know well in Holland. But the readers of this report must see that Egypt, small country as it is, does not shrink from freely spending money when it is certain of a golden harvest.

Irrigation in the Sudan.—The poverty, the scanty population, and the lack of water in the Sudan form a striking contrast to the dense population and the wealth of Egypt. At present it is little better than a derelict estate commanding no value in the market. Much money has been already spent on it (including the railway to the Red sea), and much more must be spent, but population cannot be created in a hurry. Money can only be procured in exchange for abundant harvests. Harvest can only be produced by irrigation, and at present for many months in the year there is no water wherewith to irrigate. Egypt paid for the great Aswan dam, and naturally lays claim to the water it stores. But with the dam raised 23 feet, there ought to be water enough to irrigate a large area in the Sudan.

An irrigation scheme on a great scale is not a thing to be hurried. It is first necessary to make a very careful survey of the tract to be watered. Lines of levels require to be fixed with the greatest accuracy—an error of 6 inches in a couple of miles being inadmissible. At the same time the sources of water-supply throughout the whole year must be studied, the rainfall as well as the supply from rivers. A study at the same time is necessary of the soil proposed to be watered. A scheme of drainage must be worked out. The advantages and disadvantages of combining navigation with irrigation must be weighed. The resources of the country—its timbers, its stone, its climate. Information on all these points must be obtained

before a spade is put in the ground, and there must be considered whether there is population sufficient to enable the work to be done by manual labour, or whether mechanical power must be used.

This preliminary study is still far from complete, but enough is known to decide that it would be feasible to make a great canal taking out of the left bank of the Blue Nile near Sennar, and flowing in a north-westerly direction generally parallel to that river. After flowing about 30 miles the canal would have command of the country near Wad Medani, and from there onwards for about 50 miles it would flow through rich black soil. So far as the levels of the country are concerned, and given a sufficient water-supply, such a canal as this might irrigate three millions of acres. But considering the sparseness of population and their total ignorance of irrigation, the chief engineer reports that "for purposes of discussion and estimates of possible cost, half a million feddans would seem to be indicated as a probably suitable area to be worked up to in the course of the next fifteen or twenty years." He thinks that this canal might perhaps be made for £3,000,000, or £6 per feddan benefited. So far as our knowledge of the Sudan goes, this Gezira canal is its most promising irrigation scheme.

From the foothills of Abyssinia there comes a torrent known as the Gash, which flows in a north-westerly direction past the town of Kassala, and loses itself in the desert. In the Gash valley the rains begin about the middle of June, reach Kassala early in July, and by the end of September the Gash has ceased to flow till the following June. While the rains last the Gash is a formidable river, but it is most uncertain in its flow. Irrigable land of first-class quality is commanded by the Gash, but the water-supply must be very limited unless it admits of storage, which is not probable, and the chief engineer considers 300,000 acres as the limit of irrigation possible. It is clear that irrigation from the river Gash is a problem beset with difficulties. A weir with a crest of 100 metres was built across the river, and was carried away in 1906. Again it was rebuilt in 1907, and is standing now. A small canal is drawn from the river above this weir, and some cotton and millet cultivation is practised near Kassala, but it is too soon to forecast any satisfactory irrigation from the Gash.

The whole of this irrigation report for 1908 is full of valuable information, and proves how ably the department is being administered.

NEW LIGHT ON VERRAZZANO'S VOYAGE OF 1524.

The name of the Florentine navigator, Giovanni da Verrazzano, has lately been brought before the public in connection with the Hudson celebration at New York (*Journal*, vol. 32, p. 575), from the fact (for such it has generally been conceded to be, in spite of attempts to discredit Verrazzano's narrative) that Hudson had been forestalled in his discovery of the Hudson river by the earlier voyager, who sailed in 1524 in the service of the King of France. At the time of the celebration the Florentine was duly honoured by the Italian colony in New York by the inauguration of a monument in that city, while simultaneously, in Rome, a discovery of much importance for the knowledge of his voyage was made in the bringing to light of a previously unknown version of the explorer's report, which, besides confirming in a most satisfactory way the authenticity of the voyage, adds some valuable details to the accounts previously available. A full discussion of this interesting find, with a verbal reprint of the document and facsimiles of portions of it, was contributed by Signor A. Bacchiani to the *Bollettino* of the Italian Geographical Society for November last.

Hitherto, as is well known, our knowledge of the voyage has depended almost entirely on a manuscript version of Verrazzano's letter to the French king, preserved in the National Library at Florence, and on a printed version of the same report included by Ramusio in his Collection of Voyages. The new manuscript, though coinciding in the main with the Florence version, proves to be of far more value by reason, not only of its greater authenticity, but of the considerable number of additional notes incorporated in the original draft. By a closely reasoned argument Signor Bacchiani shows the great probability that the manuscript (which lately passed by inheritance into the hands of Count Guillo de Cèllere) was once the property of Verrazzano's contemporary, the celebrated Paulus Jovius, and also that a portion, at least, is in the actual handwriting of the navigator himself. While the body of the letter is in the formal hand of an amanuensis, the corrections and additions are in a more running hand, the same in which the address of the despatch was written. This runs, "A Leonardo Tedaldi o a Thomaso Sartini mercante in Leone. Mandaretelo a Bonacorso Ruscellay." Now, Lyon was at the time a great business centre much frequented by Italian merchants, who had dealings with all the principal cities of Western and Southern Europe. The merchants named would thus afford the most natural and easy means of forwarding the despatch to Italy.* Ruccellai, the correspondent in Rome to whom it was to be delivered, was a well-known banker, whose partner was none other than Bernardo de Verrazzano, no doubt a relative of the navigator, between whose family and his own, intimate relations are known on other grounds to have existed. Everything, therefore, points to the absolutely contemporaneous character of the manuscript, and the internal evidences of authenticity are no less striking.

It has been mainly owing to the American writer Murphy that doubts as to the genuineness of Verrazzano's voyage have been entertained, and it was from the imperfections and inaccuracies of the previously known versions that he derived his chief arguments. It is thus important to find that most of the difficulties disappear when the much more accurate version now brought to light is examined. The illiterate scribe who copied the Florence version has not only played havoc with the sense and with the spelling of the names, but has in one case at least exactly reversed the meaning of the navigator. Among the examples of utter perversion of the sense, perhaps the most striking is that in which the words "sito terrestre," occurring in the new manuscript, have been changed to the meaningless phrase "lo equestre," which has naturally been a hopeless puzzle hitherto. Another important correction, tending to place Verrazzano's cosmographical notions in a new and more favourable light, refers to a passage near the end of the report, in which the continental character of the lands discovered is discussed. So far from speaking of America as "congiungendo alla Asia et Africa," the explorer positively asserted the independence of America from either of those continents, his words really being, "*non* giungendo alla Asia *ne* all' Africa." He was thus among the first to recognize fully the true character of the New World, though hardly, as Signor Bacchiani suggests to be possible, quite the first to do so.†

The marginal and other additions, in the hand supposed to be Verrazzano's, are important as containing definite references to the naming of places, some of which

---

* Tedaldi, one of the Lyon merchants, is spoken of as an old man, twenty years later, by Benvenuto Cellini in his narrative of his journey from Paris to Lyon, 1545.

† Verrazzano considered it not impossible that America might be joined to Europe in the extreme north. In this he may have been influenced by representations such as that of Fra Barbolan in the 1514 Venice map lately reproduced in the *Journal* (vol 31, p. 199). The idea still finds expression in Gastaldi's map, in the Venice Ptolemy of 1548.

subsequently appeared in maps (like that of Maggiolo, 1527) recognised as based on the voyage of 1524, though no mention of the names was to be found in the Florence version. The most important note is perhaps that relating to the supposed isthmus separating the Atlantic from the "Indian" ocean, which is the most characteristic feature of the Verrazzanean group of maps. It completely disproves (if that were needed) the theory of Murphy that the narrative of the voyage had been invented on the basis of Diego Ribero's map, which gives no indication of such an isthmus. In many other ways the new manuscript rehabilitates the credit of the navigator, and its discovery is a testimony to the value of celebrations like that of last year, which, by the attention they attract to historical questions, are not unfrequently the means of bringing important documents to light.

A CONTRIBUTION TO GEOGRAPHICAL BIBLIOGRAPHY.*

THE publication of these two weighty and well-printed volumes will confer an inestimable boon upon students of geography and history both in the United States of America, more especially in Washington, and also in the Old World, where no similar catalogue of atlases as yet exists. Mr. Lee Phillips is well known to the readers of the *Geographical Journal* as the learned author of many special bibliographies of maps, called for by military or political exigencies in the United States, though some of these are unfortunately out of print. In his official capacity he has done his utmost on a somewhat limited grant to establish in the Library of Congress a collection of maps qualified to meet the requirements of even the most ardent students of American cartography, and by general excellence and extent adequate to offer a fit complement to the other more famous American map collections, owning *unica* and cartographical rarities, but not sufficient in themselves for the requirements of general students.

The chief feature of the Congress Catalogue of Atlases is the detailed complete list of maps in each atlas of unusual interest, *e.g.*, Sir Robert Dudley's *Dell' Arcano del Mare . . . Libri sei*, Firenze, 1646–47, fol. (pp. 203–217). Of this rare and beautiful work, executed by an Englishman, there are but few copies now extant. In America there are complete copies in Harvard University Library, and in the Library of Congress. In Europe the finest copies are to be found in Mr. Thomas Grenville's noble library in the British Museum, and in the Bibliothèque Nationale at Paris.† The original MS. in the Royal Library at Munich contains even more maps than were finally printed.

In cases where the complete list of maps is not set out in detail, the list of all such maps as relate to America is given. The principle of analysing the contents of an atlas has not hitherto been attempted on a large scale. Booksellers and auctioneers will now be enabled to catalogue their atlases with more care and precision than is the case even in London, where the unrivalled resources of the British Museum collection of printed and manuscript maps are open free to all

* 'A List of Geographical Atlases in the Library of Congress.' With bibliographical notes. Compiled under the direction of Philip Lee Phillips, F.R.G.S., Chief, Division of Maps and Charts. Vol. 1, Atlases, pp. xiii. 1–1208. Vol. 2, Author List, Index, pp. 1209–1659. Washington: Government Printing Office, 1909. 4°. *Price* $2.35 [11*s.* 6*d.*]. 7 × 9½.

† There is a copy, in good preservation, in the map-room of the R.G.S. The 'Atlantic Neptune,' referred to on the next page, is also represented there by one complete and two incomplete copies.

comers, not to mention the maps in the collection of the Royal Geographical Society, under the care of Mr. E. A. Reeves. It will be easy, too, for Mr. Lee Phillips to trace and to recognize the editions which are requisite to fill up any unpleasant gaps in the collection at Washington. It is only due to that veteran bibliographer, Mr. Edward Arber, to note here that the publication of his interesting 'Term Catalogues,' 1668–1711, in three volumes, has made it possible for exact dates to be assigned to many maps of great importance in the history of the expansion of the United States and of British North America, where the British Museum Catalogue of Maps had not been sufficiently precise in fixing the probable or possible date of publication.

The bibliographical researches of Mr. Henry Newton Stevens, F.R.G.S., in continuation of the literary labours of his learned father, Mr. Henry Stevens, of Vermont, have also contributed not a little to the excellent chronology of the catalogue of atlases under notice. The recent second edition of the description of the unique Stevens-Ayer collection of Ptolemy Atlases at Chicago, issued by Mr. H. N. Stevens in the spring of last year, was also of the greatest assistance to Mr. Lee Phillips. Many fine copies unknown to Winsor and to Eames have passed through Mr. Stevens's hands, in the study of a subject which he has made peculiarly his own. The first edition of Mr. Stevens's essay was issued for private circulation but this second edition of a book which is indispensable to every curator of maps, has been published at a price within the reach of every librarian.

The zealous industry of Mr. Lee Phillips has conferred many benefits on cartography in general, and on the British Museum Catalogue of Printed Maps in particular, by his thirst for information, which has led to the reprinting and redating of such a large number of titles of the American maps in the national collection at Bloomsbury. It may be noted here that the date of 1762 assigned at Washington to the *Atlas geographicus portatilis* of Tobias Conrad Lotter, the son-in-law of Matthias Seutter, of Augsburg, appears more probable than the date of 1720, as given in the first edition, 1885, of the Museum Catalogue of Printed Maps, quoted by Mr. Phillips (p. 368). The "Accessions" to the Museum Catalogue, now published annually by the Superintendent of the Map Department, have, however, altered a date more flattering to the precocity of Lotter than true in fact, as in 1720 Lotter was but three years old, and not as yet a rival of his famous future father-in-law.

On page 616 the entry of 'The Crown Collection of Photographs of Maps selected and edited by Archer Butler Hulbert,' 5 vols., 1904–1908, will interest English students of geography, in that the originals are to be seen at the British Museum in the Royal Library bequeathed to the nation by King George III., and among them is the famous set of views in Upper Canada, drawn on birch-bark by Mrs. Simcoe, and presented by her husband, Governor Simcoes, to King George III.

Another benefit conferred on us by Mr. Lee Phillips is that we have here the contents of Thomas Jefferys's colossal work, 'The General Topography of North America and the West Indies,' 1768, set out in full in print for the first time, 109 maps in all, as is also the case with 'The Atlantic Neptune,' by Joseph F. W. Des Barres, 1774–81. Rich says of these three elephant-folio volumes that "they form the most splendid collection of charts, plans, and views ever published. It was executed at the expense of the British Government for the use of the British Navy, and no expense appears to have been spared in the execution in order to render it a monument worthy of the nation." It is a remarkable fact that as many as *eight* copies of this grand work are now in the Library of Congress. The one copy in the Map Department of the British Museum is at present mainly in good preservation,

though the third volume is unfortunately still in loose plates and unbound, and, if this undeserved parsimony be not soon repaired, is likely to deteriorate every year by dust and friction. The English Admiralty, even under Sir Charles Inigo Thomas, has produced nothing since in volume form to equal the grandeur of 'The Atlantic Neptune.'

Space does not allow the mention of every atlas of interest, but attention must be drawn to the Congress sets of the atlases of Ptolemy, Abraham Ortelius, and Gerard Mercator, which form no unworthy rivals to the sets in the Map Department of the British Museum, which were brought together and placed in three handsome oak cases some eight or nine years ago, arranged in chronological order, according to size. The set of Ortelius atlases has recently been carefully recatalogued by Mr. Thomas Chubb, but was not printed in the Accessions soon enough to assist Mr. Lee Phillips.

The "Index of Publishers and Engravers" is not the least interesting part of Mr. Lee Phillips's valuable catalogue to the student of historical geography. In map collections of any size, a title index, as adopted by Mr. George F. Barwick in the British Museum Catalogue of Printed Books (*q.v.* "England," etc.), is essential to select quickly the requisite object and to prevent the purchase of duplicate maps or atlases. In the next supplement to Mr. Lee Phillips's monumental work a title-index will probably be included, and then nothing else seems left to be wished for. Such a work is of the greatest credit to the Map Division of the Library of Congress and to its indefatigable and learned chief. It may well spur the superintendents of the Printed and Manuscript Map Departments in the British Museum to produce a printed catalogue of their entire collections, up to date and up to modern requirements. The Catalogue of Printed Maps was last printed in 1885, and the Annual Accessions appear to be printed in too small quantities to meet the demands of all the geographical libraries who have received or acquired the original edition of 1885. The map entries are in many cases unduly abbreviated, sometimes incomplete, and occasionally incorrect. The Museum Catalogue of Manuscript Maps has not proceeded beyond volume 3, published in 1861, and lacks an authors' and a title index. For bibliographical purposes it is practically useless. It was hoped that in 1909, when the British Museum was celebrating the anniversary of its foundation in 1759, 150 years ago, these two Map Catalogues might have been issued after the style of a German Academic *Festschrift*. The trustees of the British Museum have the finest collection of maps in the world under their charge at Bloomsbury, and their officials are, it is to be hoped, no less industrious than Mr. Lee Phillips's little band at Washington. The Congress Library has at present far outstripped the British Museum in the amount and in the quality of its cartographical publications.

Finally, a few statistics. In Mr. Lee Phillips's 'Catalogue of Atlases' there are some 3265 entries of atlases in vol. 1, in 1208 pages. In vol. 2 there are 450 pages. There are not more than some six misprints in the two volumes, which should certainly find a home in every geographical library of reference throughout the civilized world.

F. S. A.

REVIEWS.

EUROPE.

The North Sea.

'Fishery and Hydrographical Investigation in the North Sea and Adjacent Waters.' Second and Fourth Reports (Northern Area). Part I. Hydrography. 1904–1906 and 1906–1908.

In these two reports we have a full account of the hydrographical researches undertaken in the northern area of the North sea and in the Faroe-Shetland channel by the Scottish Fishery Board in connection with the International Fishery Investigations of the North sea.

As these reports are issued from time to time, a vast amount of valuable information is afforded upon the hydrographical and biological conditions prevailing in the North sea, a sea that provides employment and food for many thousands of British fishermen and others. Apart from the purely scientific aspect of these researches, we have their application to the betterment of the fishing industry. We may also derive some benefit in the near future with reference to our meteorological conditions and how they are affected by fluctuations in temperature and difference in current movements in the North sea.

The investigations go to show, without a doubt, that a steady stream of Atlantic water is continually flowing as a surface current into the Norwegian sea through the Faroe-Shetland channel. The average depth of this body of Atlantic water is 500 metres, and it moves with a velocity of 12 to 16 miles in twenty-four hours. In early summer the flow is greatest, and towards autumn it falls off to a velocity of about 5 miles in twenty-four hours.

It is evident from this that a very considerable volume of Atlantic water finds its way into the North sea. The current does not seem to be controlled by definite laws, but pulsates irregularly with the seasons. The early months of summer are characterized by the surface waters of the north-western area of the North sea having a high salinity, and the inflow of Atlantic water, after attaining its maximum in April, apparently continues through May and June with unabated vigour. In winter the water of high salinity gradually recedes northwards towards Shetland, and the influx of Atlantic water evidently becomes exceedingly limited in area. There are few exceptions to these seasonal pulsations, and these seem to be due to abnormal meteorological conditions. Very extensive current movements in the North sea, such as a large inflow of warm Atlantic water, must affect the meteorological conditions considerably. This was shown to be the case in 1905, when one of the mildest winters experienced in Scotland for thirty-five years occurred concurrently with an exceptionally large inflow of Atlantic water. Of course, as already pointed out, this large winter inflow is abnormal, and may be due to variations in Arctic atmospheric conditions and increase of pressure over the North Atlantic during the preceding summer.

The cold dense water of the Norwegian sea flows slowly southward as a bottom current along the Faroe-Shetland channel towards the Wyville-Thomson ridge. This current moves very slowly, not more than 3 miles in twenty-four hours. Slight differences in temperature are apparent even in the deeper layers.

These results are very interesting, and as the information grows we may look forward to having some thorough knowledge of the current movements in the North sea based upon definite and established laws. This is at present hardly possible owing to the difficulty experienced in making winter observations.

The influx of Atlantic water into the North sea must affect the movements and quantity of fish to be found on the more northern grounds. With the inflow of fresh oxygenated Atlantic water containing plenty of food, the fish are abundant, but as the water becomes stagnant and the food-supply exhausted the fish move to more favourable grounds. These seasonal differences in current movements, salinity, and temperature may also be very largely responsible for the migrations of the herring.

In the observations upon the direction and velocity of the bottom-currents some interesting results are being obtained by the use of drift-bottles; they are of much the same size and shape as ordinary soda-water bottles, and are made of hard glass to resist pressure. Each bottle is fitted with a screw stopper rendered water-tight by being dipped in pitch. The weight of the bottle is carefully adjusted by means of small shot placed in the neck. Two feet of straight copper wire is attached to the neck, and the bottle tested to ensure that the specific gravity is slightly greater than that of sea-water, so that it will sink slowly neck downwards until the tip of the copper wire that is attached touches the bottom. The slightest pressure on the tip of the wire relieves the weight, and the bottle tends to float, so that the trailing wire prevents the bottle from resting upon the bottom provided its specific gravity remains constant, and it moves along with the bottom current poised 2 feet or so above the sea-floor. Each bottle carries an addressed card inside bearing the necessary instructions for finder as to locality where found, depth, etc. Only about twenty per cent. of these bottles are recovered, and the usual juggling methods of statistics make the results somewhat interesting. Many things may happen, and do happen, to drift-bottles before they are recovered, judging from some of the queer corners they sometimes arrive at. One thing that does happen to a good many of those recovered, and in all probability to those "lost, stolen, or strayed" that are never recovered, is that their specific gravity is so upset by keeping company with barnacles that they take a rest on the bottom. Of course this is not always the case, and from the few that do turn up smiling some results as to direction and velocity of currents may be calculated.

It is unfortunate that Dr. Ekman's ingenious little current-meter cannot be used except from an anchored vessel in a calm sea.

These reports are a valuable acquisition to hydrographic literature, the text being well written and supplemented by full tables of temperatures, salinities, and many coloured sections across various parts of the North sea.

R. D.

Crete.

'Crete, the Forerunner of Greece.' By C. H. and H. Hawes. Pp. 158. Harpers' Library of Living Thought London and New York: Harper & Brothers. 1909. 2*s.* 6*d.* *net.*

This little book, beside its attractive presentation of the wonderful story of Cretan archæological discovery, touches certain problems of ancient geography which Cretan antiquities necessarily suggest. Such are the credit to be allowed to position, environment, and physical character in the explanation of the early rise of so high a civilization in a comparatively small and remote island, and of its long predominance in the Eastern Mediterranean; and also the degree to which topographical condition determined the growth and history of the several Cretan centres of that civilization. What Bérard called the "law of isthmuses" seems certainly to have had something to do with the greatness of Cnossus and Phaestus, and even more emphatically with the provincial importance of Gournia and Palaikastro. The authors—or rather one of them, Mrs. Boyd Hawes—suggest, too, a novel problem in ancient trade-communications, by expressing an opinion that the tin used by Cretan bronze-founders may have been derived from Khorassan. But, in

default of much more conclusive evidence than is offered by the superficial similarity of mottled pottery in Crete and Turkestan, this opinion conflicts too greatly with probabilities to carry conviction. The authors refer to the possibility, advanced in a certain *Times* article, that Crete was "Atlantis," and seem to favour it: but so far as the general situation and local topography of Atlantis are defined in the poetical accounts which are our only authorities, they do not square well with those of Cretan Cnossus. The book is very readable.

D. G. H.

ASIA.

The Western Himalaya.

'Peaks and Glaciers of Nun Kun. A Record of Pioneer-Exploration and Mountaineering in the Punjab Himalaya.' By Fanny Bullock Workman and William Hunter Workman. London: Constable & Co. 18*s. net*.

This handsome volume is the detailed account of an adventurous exploration of the comparatively little known locality east of Srinagar, and the route over the Zoji-la to Dras, south of Suru, and north-west of the well-known Maru Wardwan. A short account, read by Dr. Workman, in November, 1907, at a meeting of the Society, was published in the *Geographical Journal*, vol. 31, p. 12.

Preparations for the expedition were made chiefly at Srinagar, a noticeable departure from ordinary usage being the engagement of six porters and the guide, Cyprien Savoye, from Courmayeur. The porters were to carry camp outfit to points above those which coolies could climb, and they were to do their own cooking. One of them seemed to be a *chef*, for he had medals from Italian cooking societies. They had a tent-servant to help and wash dishes, "but they prepared the rest of their food over a native hearth, and, in the snows, over a primus stove, and were entirely satisfied with the arrangement. It saved us a lot of trouble, for they had everything needed, lived well, and there were no complaints."

So far good; but there was plenty of trouble with the local coolies, remedied chiefly by means of "bakhshish" in copper and silver, where in cases the variety known as "bamboo" was certainly appropriate and deserved, though possibly injudicious to bestow. For in many instances they were probably obeying the orders of some local dignitary. However, difficulties were overcome, and the journey was successfully made to the base camp, 15,100 feet high, up the Shafat glacier. A sportsman had been there the preceding summer, whose servants had made stone shelters, which were immediately appropriated by the coolies. Whether he found game is unknown, but Dr. and Mrs. Workman saw no big game, and merely mention an eagle which succeeded in carrying off a leg of mutton, and that chikor, a bird almost identical with the French partridge, abounded near the camp. Thence explorations were made, and high snow-camps were formed, to which the names "Nieve Penitente," "White Needle," "Camp Italia" (20,632 feet), and "Camp America" (21,300 feet) were given. From Camp America the final ascent was successfully accomplished, and the party stood at 23,000 feet. "By this ascent Mrs. Bullock Workman not only broke her last record-ascent for women of 22,568 feet, but won a place with Dr. Workman in the small band of mountaineers who have reached a height of over 23,000 feet." It was a great feat, specially for the lady, but all the party may be congratulated.

The return journey was by the Barmal-la to Suru, where the coolies were paid off, the guide and porters started on their return to Europe *viâ* Srinagar, and the final adjustments connected with the expedition were made. The last chapter contains the authors' views about Nieve Penitente, and deserves careful consideration. The whole story is agreeably told; where reference to the great work of the

Indian Survey Department is made (p. 162), it is in a proper and appreciative spirit. The map is ample for its purpose, whilst the illustrations, made in Germany from photographs taken by the authors, deserve much praise.

W. BROADFOOT.

AFRICA.

ABYSSINIA.

'Jean Dachesne-Fournet.' Mission en Ethiopie (1901–1903). 2 vols. By MM. Henri Froidevaux, O. Collat, J. Blanchart, Dr. Verneau, and others. Paris: Masson & Co. (1909), and Atlas (1908).

These handsome volumes form a worthy memorial of a young explorer who, unhappily, is no longer in the ranks of the living. Jean Duchesne-Fournet (a son of the well-known French senator, Mons. Paul Duchesne) died in 1904, aged 29. Young as he was, he had given proof of the possession of exceptional qualities, well fitting him to take rank with the travellers of modern days, who go prepared by previous study to make as complete an examination as possible of the various aspects of the unknown or little-known regions they visit. The scientific mission to Abyssinia organized and led by Jean Duchesne-Fournet lasted from October, 1901, to January, 1903. The main results of the work done by it had been made public in magazine articles before the appearance of this work. Nevertheless, the family of the explorer have been well advised to publish this account, not alone as an act of homage to a gallant youth, but for the valuable and varied information which it gives in easily accessible form.

The mission, of which throughout Duchesne was the guiding star, made its way from Jibuti to Adis Ababa by a new route through the Danakil country; thence, by roads partly unknown, it traversed the plateaus of Shoa and Gojam to Lake Tsana, which was encircled on foot; and finally the leader paid a visit to the Wallaga gold region. There were no great topographical discoveries to be made, though the rectifications in the map of Abyssinia were not unimportant. The mission, however, devoted special attention to geology, ethnology, zoology, and the social and economic condition of the country. To aid him in his task, the leader had obtained the services of several distinguished men. Among them were Lieut (now Captain) O. Collat, second in command, and the cartographer of the expedition; H. Arsandaux and Dr. Moreau, geologists, and Dr. Goffin, anthropologist. Nor should mention be omitted of the late Edouard Comboul, an engineer who had made a detailed mineralogical study of the Wallaga country, and who aided Duchesne in his researches in that region.

The *Mission en Ethiopie* is divided into eight parts. The story of the expedition is ably told by Henri Froidevaux from the material left by Duchesne and from information obtained from his comrades, judicious use being made of other books for descriptive passages. Captain Collat discusses the economic condition of Abyssinia; Mons. Arsandaux deals with geology, Dr. R. Verneau with anthropology and ethnography, and Pierre Lesne with insects (this last a brief section of six pages). Mons. G. Hutin has drawn the maps from the itineraries and notes of Captain Collat. A bibliography of 347 works, given by Mons. Ch. Regismanset of the French colonial office, includes 106 books which Jean Duchesne had in his library, and had consulted before setting out on his journey, an example of thoroughness of preparation much to be commended. Finally, there is a valuable section by J. Blanchart on the Abyssinian manuscripts obtained by the mission. Of these a seventeenth-century version of the life of the Saint Tekla Haymanot is of considerable value, and a translation thereof is given in full. When it is added that these various sections are illustrated by numerous maps, nearly 200 illustrations

in the text, and by 40 separate plates, some idea of the comprehensive scope of the work will be obtained.

A critical examination of the contents of the volumes cannot be undertaken here, but special attention may be drawn to Dr. Verneau's section. The very vexed question as to the origin and affinities of the Abyssinian peoples is dealt with in a lucid manner, Dr. Verneau's theses being based on the measurements of over a hundred persons by Dr. Goffin. Dr. Verneau contends that there can be identified three distinct Abyssinian types, and of these types one, the Amhara or Ethiopian type, "had its origin in the region where it to-day continues to flourish, for if nothing authorizes us to make it come from Egypt, nothing permits us to suppose that it arrived from Asia" (vol. 11, p. 261). The second part of Dr. Verneau's section deals attractively with the dress, food, home-life, arts, and religion of the Abyssinians.

F. R. C.

Uganda and the Sudan.

'Lake Victoria to Khartoum: with Rifle and Camera.' By Captain F. A. Dickinson, D.C.L.I., F.R.G.S., with an introduction by the Rt. Hon. Winston Churchill, and numerous illustrations from photographs taken by the author. London: John Lane. 1909. 12*s.* 6*d.* *net*.

This agreeable description of an interesting journey, like the author's former work 'Big Game Shooting on the Equator,' appeals no doubt more strongly to the sporting traveller than to the geographer, yet for the latter there is much of interest. The author commanded Mr. Churchill's escort from Uganda to Gondokoro, and beyond this place he accompanied the Under-Secretary for the Colonies as a guest to Khartum and Omdurman. The journey was most agreeable. Mr. Churchill found Captain Dickinson an ideal companion and guide, whilst the captain testifies to Mr. Churchill's excellence as a shot. "He would make a 'top-hole' shot if he had the time to spare." The route followed was from Victoria Nyanza, or say Bombo, the headquarters of the 4th Battalion King's African Rifles, passing between the Myanja and Lugogo rivers to Masindi, where there is a great junction of highways; thence through the great Budonga forest, the game reserve being on the one side of the road, to Lake Albert, where at Butiaba there is a natural haven for the Nile flotilla. The journey down the river is well described and worthy of study by intending travellers, but it need not in this notice be further mentioned.

On his return journey Captain Dickinson crossed the Nile into the Lado Enclave, hitherto leased to the Belgians or to King Leopold, but which is eventually to be taken over by the Sudan Government. The few pages describing this *détour* into the Congo mountains form, from a geographical point of view, the most interesting part of the book. This is well got up, and liberally illustrated, and there is an index, which might with advantage have been more full. There is no map; a serious defect for readers whose knowledge of the geography of these parts is elementary.

W. Broadfoot.

The Heart of Central Africa.

'Ins Innerste Afrika.' By Adolf Friederich, Herzog zu Mecklenburg. Leipzig: Klinkhardt & Biermann. 1909. Pp. vii.–xi. and 1–476. *With* 240 *Illustrations and* 2 *Maps. Price* 14*m.*

This volume contains a general account of the Duke of Mecklenburg's travels in German East Africa and the Congo Free State during 1907–1908. The expedition, which has been frequently referred to in the *Journal*, was a very important one, and provided with all sorts of apparatus for scientific work, including universal instruments, phototheodolites, deviation-magnetometers, twenty-six loads

of botanical paper, phonograph and rolls for native languages, forty loads of medical stores with microscopes and reagents, twelve loads of photographic plates, gramophone, etc., etc. These loads alone amounted to over seven hundred, and, as the personal baggage and other stores were on a similar scale, no less than two thousand porters were required.

The Duke of Mecklenburg was accompanied by nine other Europeans, namely, Lieut. von Wiese und Kaisers Waldau (caravan leader and meteorologist), Lieut. Weiss (geographer), Herr Kirschstein (geologist), Dr. Schubotz (zoologist), Dr. Mildbraed (botanist), Dr. Czekanowski (anthropologist), Dr. von Raven (doctor), Sergeant Czeczatka, and his servant Fr. Weidemann.

Most of the Europeans landed at Mombasa on May 30, and travelled by the Uganda railway to the Victoria Nyanza, and thence by steamer to Bukoba on the western shore, which was the starting-point of the expedition. Leaving this place on June 17, the north-western part of German East Africa was thoroughly explored in several directions; Lake Kivu, of the volcanic group of Namlagira, Ninagongo, and Sabinjo, was next visited and collections made in the Bugoie forest and on the islands of that lake. Thence the expedition proceeded northwards, visiting both shores of the Albert Edward Nyanza, and by the Semliki valley to Irumu, and thence by Makoko to Avakubi on the Aruwimi river. They then returned home down the Congo by canoe, steamer, and railway to Banana.

It will be seen that the route followed is one which has been traversed by many British travellers (none of whom are mentioned in this volume). The duke himself visited the extreme north-east of Uganda (between Ruwenzori and the Albert Nyanza), and another member of the expedition traversed Ankole and went on by Fort Portal to Irumu, but, except for these small excursions, the route lay entirely in German East Africa and the Congo Free State.

This volume is a very interesting one and full of valuable information, both on political and scientific matters. Although His Highness mentions that he was "als Soldat erzogen, auf dem Rücken des Pferdes gross geworden," very few African explorers have shown themselves able to describe countries, peoples, and incidents of travel in such a clear and lucid manner. The author has the gift of seizing on all that is really important, and is not without a sense of humour (as is shown, for instance, by his account of a victory gained by swarms of infuriated bees, which completely routed the whole expedition). The hunting stories are well told and form quite exciting reading. As both the duke and his companions made a practice of following up wounded lions in thick bush, and chasing slightly injured elephants through papyrus swamps, the reader is always expecting something. Unfortunately, Dr. von Raven, when following a wounded buffalo through thick elephant-grass, was charged and badly wounded; his life was, in fact, only saved by the bravery of his askaris.

In other respects the duke must be congratulated, for it is not given to many explorers to kill a lion, and then, turning round, to witness a volcano like Namlagira in active eruption.

The description of German East Africa and of the methods now adopted by the newer school of German officials deserves careful study, especially by those who are interested in Uganda. The scientific results of the expedition are of great value, for all seem to have co-operated and assisted one another. Thus, when shooting in a district where sleeping sickness prevailed, every one took with him microscope-slides so as to examine the blood of elephants or any other animal which might be met with; Trypanosomes were not, however, discovered. The scientific results will be described in other volumes which are in course of preparation. Maps have been made on a scale of 1 in 100,000 both of the Mpororo-Kagera and of the

volcanic district, covering over 5000 square kilometres, and many magnetic observations and stereogrammes were obtained. Most unfortunately, Lieut. Weiss was obliged by serious illness to return home before the end of the expedition. The geologist, Herr Kirschstein, spent six or seven months in unravelling the formation of the Ninagongo-Sabinjo group of volcanoes. He was most unfortunate on two occasions: once when, being caught in a sudden snowstorm on Karisimbi, twenty of his men were literally frozen to death, and again in the district south-east of the volcano Muhavura, where he was attacked by the natives and lost all except eleven of his caravan. Fortunately, he was successful in saving his geological specimens and observations.

The duke frequently quotes the actual descriptions given by his companions in the expedition. Both Dr. Mildbraed and Dr. Schubotz have some charming sketches of plant and animal life, and the future volumes promised by them will be of great importance. Dr. Mildbraed has some interesting remarks on the distribution of the lobelia flora of Ruwenzori. He also confirms the fact (already pointed out by British botanists) that the West Coast forest flora is represented even on Ruwenzori. Dr. Schubotz made an enormous collection of mammals (834 specimens), birds (800), reptiles and amphibia (377), fishes (708), decapods (1452), molluscs (686), insects (7603), etc., etc. These will require years of study by specialists before the results can be published.

There are many points of interest to anthropologists in this volume, such as the cave drawings from near Ruanja and the very complete account of the pigmies. A member of the expedition was even able to witness one of their dances.

As regards the photographs of scenery and of native races, they are unusually good. Indeed, those which refer to the African forest seem to be equal to the very best that have as yet been published.

With the exception of Lieut. Weiss and Dr. von Raven, the party enjoyed excellent health, which is ascribed by the duke to their having taken one gr. of Koch's malaria prophylaxe every seventh and eighth day. But we doubt if the duke quite realizes how much he is indebted to the Uganda railway and Victoria steamers, which landed the whole expedition at Bukoba in European health.

G. F. S. E.

AMERICA.

Chile.

'Acht Lehr- und Wander-jahre in Chile.' By Prof. Dr. Otto Bürger. Leipzig: Weicher. 1909. Pp. 410. *With* 37 *Illustrations and Index. Price* 10*m.*

The author accepted a professorship at the University of Santiago and spent seven to eight years in Chile, during which he visited Chiloe, Concepcion, Valdivia, as well as Coquimbo and the nitrate districts. The illustrations are for the most part from photographs taken by himself.

Some of the pictures of forest scenery and vegetation are both interesting and characteristic of Chile. The book contains all sorts of information; there are valuable notes referring to the marine flora of Chiloe, and a graphic account of the 1906 earthquake, so far as it affected Santiago. As regards social, political, and financial matters, the author is very outspoken and a trifle dogmatic in his assertions. He says, for example, on p. 189, "The Chilian steals everything," and on p. 190, "Kein Chilene besitzt moralischen mut," and there are also such statements as "Chile possesses no history prior to 1812," and "the German zone stretches from 37° to 42° S. lat." Such criticism is hardly to be taken seriously, of course, but nevertheless leaves an impression which might seriously mislead any one ignorant of the country.

G. F. S. E.

Chilean Surveys.

'Republica de Chile. Primera Memoria del Director de la Oficina de Mensura de Tierras pasada al Señor Ministro de Colonizacion en Abril de 1908.' Santiago de Chile: Imprenta i Encuadernacion Universitaria, 1908. Pp. 227.

The co-ordinates and altitudes of the pyramids erected up to the time of publication on the frontier between Chile and Bolivia, and also of points on the frontier towards Argentina, besides some data regarding the boundaries of the province of Tarapacá and the departments of Cañete and Traiguen. It has also been decided to compile a map of the northern provinces. For this work it is estimated that ten years will be required, drawing, engraving, and printing being included. A commencement has been made by determining a number of points on the primary triangulation, and the co-ordinates of these are given. The greater part of the volume deals with surveys for settlement and for fixing the limits of properties already occupied.

POLAR REGIONS.

Antarctic Meteorology.

'Wissenschaftliche Ergebnisse der Schwedische Südpolar-Expedition, 1901–1903.' Edited by Dr. Otto Nordenskjöld.

(*a*) Vol. 2, part 1.—'Meteorologische Ergebnisse der Schwedischen Südpolar-Expedition. Stündliche Beobachtungen bei Snow Hill.' By Gösta Bodman. Stockholm. 1908.

The expeditions which went to the Antarctic under international co-operation between the years 1901–1904 will ever be memorable for the large amount of scientific data which they collected. The volume under review is a worthy example of the conscientious work which was done under very trying circumstances by the scientists who accompanied the several expeditions.

The meteorological work of the Swedish expedition has been divided into three parts—

(1) Observations on board the *Antarctic* during the period December 2, 1901, to February 12, 1903.

(2) The observations on the Paulet island from March, 1903, to November, 1903.

(3) The observations made at Snow hill from March 1, 1902, to November 7, 1903.

The present volume contains the simple results obtained at Snow hill, and a general discussion is held over pending the publication of the observations taken on board the *Antarctic* and at Paulet island.

In the introduction Dr. Bodman describes the exposure of the instruments used, the method and times of reading them, and the difficulties experienced in the work. The position of the winter station at Snow hill was not ideal from the point of view of meteorology; but when choosing a place in which to live during an Antarctic winter there are more important considerations to be faced than the exposure of the meteorological instruments. There must always be a compromise struck between the desire for an exposed place for the wind instruments and the thermometers, and the real need for a site as far as possible sheltered from the rigours of an Antarctic blizzard. As it was, although the observatory was surrounded by hills to such an extent that the wind observations were considerably affected, the blizzards were so bad that the anemometer was constantly damaged, and fears were entertained for the stability of the hut.

Under these circumstances we must be thankful that wind observations were obtained at all, and grateful to Dr. Bodman for the full particulars of the surrounding

hills, which make it possible to discuss the results properly. The Swedish expedition, like all the others of which we have received particulars, experienced great difficulties in taking their meteorological observations. Dr. Bodman describes his attempts to hold up a hand anemometer in a gale of wind and at the same time to determine the time of exposure by means of a watch illuminated by a flickering lantern always on the point of being blown out. His solution of the problem, by tying his watch against his ear and counting the tick-tacks, shows considerable resource, and he was evidently well rewarded by the ease of taking subsequent observations. The driven snow during the high winds was a real difficulty, in that it tended to block up the louvres of the thermometer screen, and to cake round the drums of the thermograph and hygrograph and prevent their working. These difficulties and the means taken to overcome them are fully described, so that the actual results may be taken with confidence. We congratulate Dr. Bodman and Dr. Nordenskjöld on having made valuable additions to our knowledge of the Antarctic climate under financial and other difficulties which none of the other expeditions had to face.

It is impossible to discuss yet the data in relationship to the results of the other expeditions, but the following particulars may be of interest.

The situation of the station was lat. 64° 21′ 54″ S., long. 56° 59′ 45″. Mean annual pressure = 740·42; absolute maximum pressure = 761·6, August 20, 1903, 7^h 0^m p.m.; absolute minimum pressure = 708·8, June 3, 1903, 1^h 0^m a.m. Bar reduced to 0° C. only. Height above sea-level, 13 metres. Mean annual temperature, −11°·8 C.; absolute maximum temperature, +9°·3 C., August 5, 1903, 5^h 0^m a.m.; absolute minimum temperature, −41°·4 C., August 6, 1902, 10^h 30^m p.m. Annual mean wind velocity, 8·32 metres per sec.; maximum wind velocity, 34·4 metres per sec., July 17, 1902. Prevailing wind direction, south-west.

(*b*) Vol. 2, part ii.—'Das Klima als eine Funktion von Temperatur und Windgeschwindigkeit in ihrer Verbindung.' By Dr. Gösta Bodman. Stockholm. 1908.

In this short monograph Dr. Bodman attempts to form an estimate of the severity (Grimmigkeit) of the weather experienced by the Swedish Antarctic expedition at Snow hill. He bases his work on the idea that severity is a function of temperature and wind velocity, and attempts to develop a formula by means of which the severity of weather at different times and places may be compared. It is laid down as fundamental that a certain weather may be called two, three, four times as severe as another when a body kept at constant temperature loses two, three, four times as much heat when exposed to the former weather as when exposed to the latter. In order to apply this idea, a cylinder was constructed, filled with water, and the loss of heat determined when the temperature of the cylinder was 25° C., the temperature of the surrounding air 0° C., and the wind velocity *nil*. This loss of heat was taken as the standard, and losses under other conditions of air temperature and wind velocity were then experimentally determined. A formula was constructed from the observed results of the forms—

$$S = s(1 + \alpha t)(1 + \beta v)$$

in which S = heat lost in unit time,

s = heat lost in unit time under normal conditions,

t = the air temperature,

v = the wind velocity.

The severity is then defined as S/s. α was found to be 0·04, and β +0·272.

It is obvious that this definition of severity is quite arbitrary, and that the expression obtained for calculating it would have been quite different if another

form of hot body had been used. It is nevertheless interesting to compare different polar climates by this method. For this purpose the following few examples are taken from Dr. Bodman's work:—

	t	v	s/s
	°C.	m/s	
Nansen's expedition, 1893–96	−33·0	13·0	10·5
Spitsbergen, 1899	−10·2	22·9	10·5
Franz Josef Land, 1903–05	−28·1	32·9	21·2
Snow hill	−31·1	30·1	20·6
Discovery, winter quarters, 1902-04 ...	−29·4	13·8	10·3

GEORGE C. SIMPSON.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

THE NORTH ATLANTIC.

'Scientific and Biological Researches in the North Atlantic, conducted by the Author on his Yachts the *Walwin* and the *Silver Belle*.' By R. Norris Wolfenden. *Memoirs of the Challenger Society*, No. 1. London: Rebman, Ltd. 4°. *Price* 10*s.* 6*d. net.*

On board his cutter yacht of 30 tons the *Walwin*, in 1903, Dr. Wolfenden made physical and biological observations from Valentia (Ireland) to the Færoe banks in order to add to the official work conducted by the Scotch Fishery Board. During the year 1904, on board his ketch yacht of 130 tons, the author made a splendid cruise from Valentia (Ireland) to the Azores, thence to Madeira and Gibraltar, and back to England across the Bay of Biscay to Plymouth. The cruise of 1905 covered about the same ground in order to again examine the conditions of a large amount of Mediterranean water in the Atlantic. During the years 1905–1906 the *Silver Belle* started from Dublin to Madeira, thence to Gibraltar. In 1907 Dr. Wolfenden was cruising north of Scotland from the Hebrides to the Shetland and thence to Norway.

In the chapter dealing with the observations conducted on sailing ships, yacht-owners willing to devote part of their time in making observations at sea will find many hints on the equipment of a sailing ship for deep-sea work and on the methods required.

The hydrographical part of Dr. Wolfenden's reports has been worked out by Dr. Dickson. Chapter i. deals with the hydrography of the Færoe-Shetland channel; it is reprinted from the *Geographical Journal* for April, 1908.

From the observations taken during 1904 and 1905, Dr. Dickson concludes that at different dates the extension of water from the Mediterranean varies very considerably northwards and westwards, and possibly also southwards. Whether these variations are periodic or irregular cannot be ascertained, the material supplied by two years' observations not being sufficient. Dr. Wolfenden's observations form a very valuable contribution to the steadily increasing amount of material. But they are not numerous enough to allow a general discussion for the present. During 1907 Dr. Wolfenden crossed from Shetland to Norway in response to a request from Dr. O. Pettersson, who asked him to work hydrographically across a line which he marked out, and which would connect up the observations of the Scottish, German, and Scandinavian expeditions. The full discussion of these observations is not possible until the German and Scottish observations are ready for publication.

In the biological part of the reports we find a description of some rare fishes by

E. W. L. Holt and L. W. Byrne. W. H. Tattersall gives descriptions of two new species of Amphipoda and Isopoda. George P. Farran describes two specimens of *Pyrosoma spinosum* collected by Dr. Wolfenden on board the *Silver Belle* off Cape St. Mary, Portugal, in February, 1906.

Dr. Wolfenden's reports are very interesting, and show what can be done by private enterprise. His example should be followed by other yacht-owners. As suggested by Dr. Pettersson, Vice-President of the International Council for the Investigation of the Sea, an association of yacht-owners working at sea could be of great help to science.

LEON W. COLLET.

GENERAL.

TEXT BOOK.

'Erdkunde für Schulen.' Von Alfred Kirchhoff, herausgegeben von Dr. Felix Lampe. Two volumes. Halle-a-S.: Buchhandlung des Waisenhauses. 1909. 4 *m.* 20 *pf.*

This is a new edition of this text book. The first volume, pp. 68, deals with an elementary course of world geography for the lowest class wherein it is schemed to lay a general foundation of Earth knowledge. The course opens with definitions and descriptions dealing with the Earth as a globe, and proceeds through a general summary of facts concerning the continents to a more detailed summary of each continent; Europe receives naturally more attention. The German States take up the rest of the volume (24 pages), which is designed to supply a course for the scholar round which the teacher is expected to weave his teaching, and into which vivifying ideas and exercises must be thrust in order to produce a really intelligent understanding of the subject-matter.

The second volume is designed for middle and upper sections and contains nearly four hundred pages. A study of the countries outside Germany precedes a study of Earth phenomena, and this is followed by a more expanded survey of the continents, again followed by another section on Germany and a new section on the German possessions. A chapter on Commercial Geography closes the scheme for the middle form.

The last section is devoted to the more analytical aspects of Mathematical Geography, Climate, Land and Sea Relief, Vegetation, and Population. The books are frankly text-books, and would be of use in this country to show how a people whose advance in scientific geographical work is renowned sets out to teach its future citizens under the guidance of a well-known professor in the subject. The method is "concentric:" the idea of the world as a globe comes early, and is followed at once by conceptions of a continental nature, into which is worked the study of the Home Country.

F. G. A.

SIR CHARLES WILSON.

'Life of Major-General Sir Charles Wilson, K.C.B., K.C.M.G., etc.' By Colonel Sir Charles Watson. London: Murray. 1909. *Portraits, Maps, and Illustrations. Price* 15*s. net.*

This book records the life and service of a distinguished officer of Royal Engineers, a fine type of the soldier diplomatist so necessary for the maintenance and development of our Empire. It is written clearly and dispassionately by an old comrade, and recounts a service of nearly forty years spent mostly in the Near East. For us it is the many years of arduous exploration and diplomatic work that we have to regard rather than the acute political controversy which somewhat obscured the end of his varied and useful life, and in which he was clearly the victim of fate and of the errors of a dilatory policy at home. His first geographical work was on the North American Boundary Commission in 1858, whose duty

it was to trace part of the frontier-line between Canada and the States along the difficult forest section from the Pacific across the Rockies.

The difficulties of tracing on the ground a diplomatic frontier along a parallel of latitude were here exemplified, as they have been again on recent occasions. It shows the advisability of fixing a frontier along well-defined natural features if possible, and demonstrates the great value which may accrue from even rough exploration work done previously, in assisting diplomatists to decide on some general lines before the survey parties are sent out to delimit.

It was in 1864 that Captain Wilson made his first acquaintance with the Near East, in which the remainder of his service was almost entirely spent, and in which his principal geographical achievements were accomplished.

His first experiences were on the survey of Jerusalem, a more difficult task then than now, when fanaticism was rife, and when the utmost discretion was necessary to work at the Mosque of Omar, one of the sacred places of Islam, as well as the site of Solomon's temple, to which even to-day it is a special favour to be admitted to the sacred precincts. Only two years ago the writer went round the Haram with the same old sheikh of the Holy Place, who did not fail to make inquiries for the young captain of engineers to whom many years ago he had given unofficial assistance in his explorations, and who had closed his eyes to many terrible crimes against Koranic law.

In the Sinai and Palestine exploration surveys Captain Wilson displayed the same capacity for dealing with natives and soothing their scruples, especially difficult as regards the sons of Ishmael.

It was after the Russo-Turkish war of 1878 that Colonel Wilson's more important official work commenced on the Servian Frontier Commission, where he was charged with the difficult task of setting out on the ground a frontier-line fixed at the conference table at Berlin, but contrary to the views of various warlike Balkan races on the spot. This was found most difficult in the case of the Servians and Albanians, who have not even yet composed their differences; but by painstaking investigation on the spot and personal influence with the disputants, the only reliable method in such cases, matters were eventually arranged.

Colonel Wilson was then entrusted with the more important duty of carrying out the reforms in Asia Minor promised by the Treaty of Berlin for the amelioration of the Christian races. As Consul-General for Anatolia, where he had several minor consular posts under his jurisdiction, he had the widest scope for his diplomatic talents, and for the study of geography as far as his duties went.

The whole country was still in a turmoil of unrest and confusion on the conclusion of an unsuccessful war. Circassian refugees poured into the country, and had to be found settlements somewhere; the Christian races expected untold wonders from the new reforms, so that the situation called for much energy and discretion in wearing down the inertia of Turkish officials as regards the new state of affairs and in reconciling conflicting views. The Circassians of the Uzun Yaila still remember with gratitude the efforts of Sir Charles Wilson in their behalf; they now form a compact and thriving settlement of about one hundred villages on the wild grassy uplands of this part of the Taurus. They wear their distinctive dress and speak their own language, and the writer received a very cordial welcome from them in token of the favours they had received from the Consul-General many years before. The Avshars, who originally came from Persia, and who were also visited by Sir Charles Wilson, have retired before the more vigorous Circassians into the wooded recesses of the Taurus farther south. The numerous journeys of Sir Charles Wilson and his attendant consuls contributed much to our geographical knowledge of the passes of the Taurus, and have been reproduced on the existing maps of that

region. These military consuls managed to effect a good deal and to influence the Turkish officials; although the effect was sometimes disheartening, yet their presence acted as a check on the rapacity of the worst type of officials, and gave a welcome support to those who aimed at improvement. Perhaps it is the Turk prefers to deal rather with a soldier than a civilian, for his instincts are still those of the conquering Osmanli armies who swept up to the walls of Vienna, and who ruled by the sword, and thus he thinks the man of action will perhaps understand him better than the man of the pen. Owing to a change of policy, these consuls were soon withdrawn, and it was not until the Armenian massacres of 1896, when the country was again plunged into disorder, that they were reappointed.

Sir Charles Wilson quickly found a new field for his activities in Egypt, where the rebellion of Arabi Pasha had broken out, and his knowledge of Eastern peoples and tact in dealing with them were again found most valuable.

There is, indeed, no tortuous channel to be followed in dealing with the Oriental, or abstruse principle necessary to fathom his intellect; he only requires to be treated with perfect straightforwardness, truth, and justice, and this is the method which Sir Charles Wilson adopted with such conspicuous success.

The illustrations of this book are all good, and the views of Tokat and Adalia especially so. The maps dealing with the various parts of the world in which Sir Charles Wilson travelled are exceptionally clear and good, and most helpful to the reader of a work of this nature.

F. R. M.

'Mosquito or Man?' By Sir Rubert Boyce. (London: Murray. 1909. Pp. xvi., 267. *Illustrations*. 10s. 6*d*.) The subtitle of this work, 'The Conquest of the Tropical World,' is amply justified by the paramount importance of the physiological discoveries and problems here dealt with. The volume furnishes a survey of the wonderful work done since the discovery of the association between the mosquito and the propagation of malaria, yellow fever, and other diseases, and provides a guide to the salutary measures which have been and may be adopted in various localities. It is hardly necessary to add that the book carries the highest authority, as coming from the Dean of the Liverpool School of Tropical Medicine.

THE MONTHLY RECORD.

EUROPE.

History of the Mapping of the British Isles.—One of the most thorough and well-informed studies of this subject—one which has been somewhat neglected as a whole by recent British writers—comes from the pen of a German, Dr. W. Reinhard, as dissertation for the degree of doctor at Leipzig University. We have already referred (*Journal*, vol. 12, p. 421) to the same writer's reproduction of one of the less-known maps dealt with in the larger paper. Dr. Reinhard shows a wide knowledge of the literature directly or indirectly bearing on the subject, and the monograph is so full of matters of interest that only a small part of it can be touched upon here. After an introductory section on the rise and progress of intercourse between the British Isles and the Continent, the writer deals successively with (*a*) the Portolan maps; (*b*) other maps showing the influence of these; (*c*) the land-maps down to 1564; (*d*) Mercator's great map of the latter date, brought to light only in recent years, and now first subjected to a detailed examination. Dr. Reinhard divides the portolan-maps into three main types on the basis of their

general representation of these islands, and he finds that a close examination of the nomenclature bears out this classification. One of the distinctions of a minor order is the separation of Scotland from England in certain of the maps, and several possible explanations of this are discussed. Another point considered is the standard of measurement employed, some support being found for Prof. Wagner's theory of the use by Italian chart-makers of a smaller mile than the Roman. It seems traceable in *one* of Dr. Reinhard's types, though even Wagner had not supposed it to be used in the case of the Atlantic coasts. As regards the land-maps (some of which show an unexpected knowledge of the coast-lines, possibly derived from nautical information), due importance is attached to the anonymous map of about 1300 in the Bodleian, which was a great advance on the but slightly earlier productions of Matthew Paris, and of which the influence may be traced even in the sixteenth century.* Three other contemporary maps may be placed in the same class with this, though each shows evidence of an independent origin, viz. Münster's map inserted in his 'Cosmographia' and other works; George Lilly's map of 1546 and its copies; and the relevant portion of Mercator's map of Europe of 1554. Some points of similarity with the later portolan maps are to be traced in these. Mercator's map of 1564 marks a new and important advance, though its actual author is unknown, and all suggestions on this head must remain mere guesses. Dr. Reinhard carefully considers the contents of the map, as compared both with its forerunners and with modern knowledge, besides tracing its influence on later maps.

The Avon and Don at Inchrory, Banffshire.—Mr. A. W. Gibb, of the Geological Department, Aberdeen University, suggests in an article printed in the *Transactions of the Edinburgh Geological Society*, vol. 9, part iii. (p. 227), that a struggle may have taken place in the past for the drainage of the tract of country around Inchrory, where are situated the upper reaches of the Banffshire Avon tributary to the Spey, and the Aberdeenshire Don. Cases of river piracy are not uncommon, and in the *Scottish Geographical Magazine* for 1901 (p. 185) Mr. L. W. Hinxman has described how the Feshie, one of the upper tributaries of the Spey, has captured the headwaters of the Geldie, one of the upper tributaries of the Dee, and annexed them to the Spey system. Now the Avon, which rises in Loch Avon in the heart of the Cairngorm mountains, makes near Inchrory a sudden bend at right angles, and from that point flows due north till it joins the Spey at Ballindaloch; and it is noteworthy that the head of the Don valley lies less than half a mile to the east of the bend of the Avon at Inchrory, lying, in fact, in direct continuation of the line of the Avon valley above the bend. The question is raised whether this right-angled bend represents an elbow of capture. Between the present levels of the head of the Don and Avon at Inchrory there is an abrupt gradient, and anything like a recent act of river piracy is inconceivable. Mr. Gibb is of opinion that what probably happened is this: the Don at one time rising in Loch Avon flowed eastwards to Inchrory, and thence still eastwards into the present Don valley; but the Avon, a tributary of the powerful Spey, by cutting back southwards along the strike of the beds, met the Don at Inchrory and beheaded it, drawing its upper waters into the Spey system, and forming the elbow of capture

* Dr. Reinhard does not seem to have noticed the definite point of connection between this and the British Museum map reproduced by him, to which attention was drawn in our former notice. As regards the anterior limit of date to the British Museum map, it appears that his inference drawn from the reference to Argyll was based, not on the form of the name, but on the error in point of fact common to the map and Polydor Vergil's account. This, of course, adds decided force to the argument.

at Inchrory. The Don was no longer able to fill its upper valley, and was left destitute of erosive power. But the Avon has gone on deepening rapidly since the time of capture, and is now 200 feet below the Don. Erosion by the Avon may have been rendered easier by its more powerful current and stronger "leverage" as a tributary of the Spey, by its working parallel to the strike of the beds, and by its flowing for a considerable distance over easily denuded limestone rocks.

The Warnow Region in Mecklenburg.—Another of the many careful studies in regional geography appearing in Germany is supplied by a recent monograph by Dr. A. Schulz, which treats of the historic course of settlement in the Warnow district and the geographical conditions influencing it. The periods of settlement include (1) Teutonic (*Germanisch*) reaching down to the fifth century; (2) Slav, down to 1100; and (3) German (*Deutsch*), 1100–1300. An introductory chapter sketches the geography proper of the region. It is bounded on the south and south-west by a line running from Nossentin heath to the north side of Schwerin lake on the lacustrine plateau forming the watershed between the North sea and Baltic; on the west and north-west by a watershed bending south-west to north-east from the north side of Schwerin lake to Warnemünde; on the east by a watershed which, beginning on the Nossentin heath, runs at first east to west to near Great Bäbelin, and then, bending northwards to the sources of the Lossnitz, proceeds deviously to Warnemünde. The Warnow, the main drainage artery, rising near Grebbin, runs north-west and north with an upper course of 46 miles, and a lower course, beginning at Warnow, of 35 miles. The southern portion—south of the northern slope of the lacustrine plateau—has the character of a moraine, strongly undulating and hilly regions alternating with steep heights rising into the aspect of mountains. In the troughs between the heights and on the ridges are lakes and marshes confusedly scattered. The North Warnow region, on the other hand, is a gently undulating plain, seldom interrupted by low heights, and set with numerous lakes and water-holes. It consists alternately of heavy clay with boulder marl producing wheat and splendid beech, and sandy soil growing potatoes, oats, buckwheat, pine, and poplar. The larger sandy plains are in the southern region. Pine predominates on the Nossentin, Karow, Woost, Schwinz, Dobbertin, and Turloff heaths. By far the greater part of the region is arable. Trade and commerce take a subordinate place, and mineral deposits are wanting. The Warnow river is navigable only as far as Bützow.

The Climate of Austria.—The K. K. Zentralanstalt für Meteorologie und Geodynamik is issuing, under the title 'Klimatographie von Österreich,' a series of studies upon Austrian climate based upon systematic observations covering a long period of years. In the second number of the series the results are given for Trieste and the Austrian coast-lands, and in the third number for the dukedom of Steirmark (Styria). At Trieste the mean annual temperature is 57° F., and at Graz in Styria only 48°·6 F., as against 49°·4 at Greenwich. The Graz temperature is somewhat low for the latitude, a fact which is no doubt due to its elevation of 900 feet above sea-level, and to the cold influence of neighbouring Alps; whereas Trieste, situated on the shores of the Adriatic and protected from the north by mountains, is a little too warm for its latitude. For the fifty years 1851–1900, the lowest mean temperature of the air at Trieste is 40°·1 F., in January, and its highest 76°·0 F., in July, the Graz figures being 27°·0 F. and 67°·8 F. The rainfall at Trieste is a little over 1000 mm. (40 inches), and the number of rainy days is 109, six of these being snowy. At all stations in Styria the number of frosty days in the cold months is very great, but except at one or two high-level ones frost does not occur in June, July, or August. All the various elements of climate are thoroughly discussed in these publications, and the results will be valuable to meteorologists.

The Origin of the Bosporus and the Dardanelles.—On the much-vexed question of the origin of the Straits of the Hellespont and Bosporus, the geologist, Prof. Rudolf Hoernes of Graz, has put forward views which merit consideration on the part of geographers. The new hypothesis avoids the improbable assumption of upheavals of extensive regions, and is based throughout on established results of observation; postulating, on one hand, the once lower level of the Pontic inland sea, as demonstrated by Andrussov (since 1898) and Sokolov, compared with that of the present Black sea; on the other hand, the existence of an ancient Ægean continent on the site of the present Ægean sea, as proved by Neumayer and Eduard Suess. Prof. Hoernes accepts the fluvial origin which A. von Hoff endeavoured to establish as early as 1822, but, unlike Cvijić, whose detailed discussion of the subject appeared in 1908, he assumes a current running, not in a south-westerly, but in a north-easterly direction. By way of illustration, he points to the limans of South Russia, which, according to Sokolov, were formerly river-valleys, but later on filled by the sea—just like the Golden Horn of Constantinople and the limans of Kütshük- and Büjük-Chekmedje on the Sea of Marmora. Their formation is bound up with the former low level of the Pontic inland sea, which, in opposition to Sokolov, English in 1904 relegated, not to the last glacial age, but, rightly, to the early Pliocene age. As regards the Bosporus at least, English had already assumed a river directed towards the Black sea, and the slope of the ground, bars, and pools all go to show that this assumption has incomparably more probability on its side than the opposite one. The present saline under-current is much too slow to account for the closed basins such as are now counted to the number of five on the floor of the Bosporus. In one particular only is Hoernes in conflict with English. He assumes for the Hellespont a river running, not in an opposite direction, or towards the Ægean, but, in consideration of the uniformity of the two straits in conformation and depth, in a similar direction to that through the Bosporus. He thus holds that a uniform current towards the Black sea eroded the Straits of the Dardanelles and the Bosporus, with their winding courses, in the Pliocene age draining the Ægean continent towards the Pontic depression. It is evident that further observations and investigations will be needed to confirm the correctness of this attempt at a simple solution of the geological problem of the Bosporus.

ASIA.

Japanese Expedition to Chinese Turkestan and Mongolia.—The young Japanese traveller, Mr. Zuicho Tachibana, who lately carrred out an interesting journey of archæological research through the northern parts of the Chinese empire, informs us that he is about to start on a new expedition to the same region, again under the auspices and at the expense of Count Kozui Otani. The archæological spoils of the former expedition were left at Kashgar, as permission to cross the Karakoram pass could not be obtained from the Indian Government. Mr. Hashiramoto, who will join the new expedition as naturalist, will therefore proceed from Peking to Kashgar *viâ* Kwa-hua-cheng and Guchen in order to fetch the collections, and on his return will be met by the leader (who hopes to enter Central Asia from the Russian side) at Hami. At Guchen and Turfan systematic excavations will be carried on by Mr. B. Aoki, the leader meanwhile making a trip to Sachu by the route used as a highway during the Han and Yan dynasties. Returning to Hami, he proposes to go east-north-east to the Yellow river (striking the latter in about 41° N., 107° E.), with a view to clearing up doubtful points in existing maps, and if possible throwing light on questions of historical geography by an examination of the ruins of fortresses, etc., near the northern bend of the Hwang-ho. Afterwards he hopes to go *viâ* Ning-hsia to Liang-chou, and thence

to Suchou, searching *en route* for Buddhist remains. From Turfan Mr. Hashiramoto will proceed to the Eastern Tian Shan with a view to geological and botanical work, afterwards examining the country towards Ansi in order to ascertain whether it once formed the bed of a lake. A special subject of inquiry will be the relation between the Lop depression, the Edsina depression, and the tract near Ansi; and for this purpose he will visit both the Edsina lake and the Kara-nor west of Sachou. At Lan-chou he will join Mr. Tachibana, the two travellers then possibly making their way to Cheng-tu along the 104th meridian. Mr. Aoki will also meet the other members of the party at Lanchou, but will then go direct to Peking or Hankow with the baggage. The duration of the expedition will probably be eighteen months.

A Memento of the Portuguese Occupation of Ormuz.—Mr. F. Jardim, who, though a Portuguese by birth, lately paid a visit to Ormuz as third officer on board the British s.s. *Registan*, sends us some notes on an old Portuguese inscription which he found among the ruins dating from the period of the Portuguese occupation in the sixteenth century. It was engraved on an iron plate which had evidently marked an ancient burial-place, and, though partly defaced by rust, still permitted the greater part of the inscription to be read. Mr. Jardim has submitted his copy to experts, and though some of the words are imperfect, enough can be deciphered to show that the inscription marked the tomb of one Ambrosio Gomes, and various relatives or connections, among whom the names Dias, De Sousa, and Ruis can be made out. Only the first three figures of the date, viz. 151, are legible, but these (if correctly read) prove that the inscription dates from the second decade of the sixteenth century, or from the time when Ormuz was first brought under Portuguese influence by the great Albuquerque. Mr. Jardim suggests that the ruins (the most striking of which are those of the old fort or castle on the western side of the island) would repay a more careful examination than they have yet received.

Mining Industry in Kansu. Exploration on Tibetan Frontier.—The *Société Belge d'Études Coloniales* states that during the last three years the Chinese Government has been employing four Belgian experts to develop the resources of the remote province of Kansu, and that these persons have been mainly occupied in exploiting copper-mines at Yao-Kai, a small village upon the mountains five days' ride from the capital, Lanchow-fu. There is a large native staff, and the four Belgian officials consist of M. De Deken, mining engineer, Mr. R. Geerts, chemist, M. Scaillet, mechanical engineer and fitter, and M. Contelier, manager. The workshops have been in operation for some months, and both smelting and refining the metal are there carried on, while the Imperial authorities have it in contemplation to start fresh industries at no distant date. Mr. Geerts, the chemical expert, has sent home some notes of his explorations on the Tibetan frontier. He seems to have made up his caravan at Sining, but as his narrative shows an almost entire lack of names beyond that place, it is impossible to follow his route. He says that the conciliatory policy lately adopted by the Chinese in this region is already leading to good results. Since the British expedition of 1904, the people of Northern Tibet had shown a profound respect for their Chinese masters.

AFRICA.

Evaporation in Egypt and the Sudan.—In Paper No. 15 of the Egyptian Survey Department (Cairo, 1909) Mr. B. F. E. Keeling attempts to summarize the present knowledge of the rate of evaporation from water-surfaces in Egypt. First of all, the results are given of a series of comparisons which have been made between several types of evaporimeter that have been used in Egypt.

The chief patterns are those of Piche and Wild, together with Wade's tank vaporimeter, and in order that the readings of one may be converted to the standard of another a factor must be applied. The ratios of one instrument to another are not sensibly affected by differences of climate, so that readings are comparable for stations with very different atmospheric conditions so long as the conditions of exposure are the same and the mean wind velocities do not greatly differ. A series of observations made at Bombay has shown that the evaporation from open spaces decreases with the area as follows :—

Area of open space (square feet)	1	10,000	lakes
Evaporation	1·45	1·3	1

hence it is important to apply some correction to the readings of instruments of necessarily small evaporating surfaces in order that one may approximate to the true evaporative conditions over the large surfaces of lakes and reservoirs. The evaporation from the Aswan reservoir averages 5 mms. per day as the mean for the year, and from Lake Quarun, situated in a very different climate, 7·5 mms.; but allowance should be made for the brackishness of Lake Quarun, since the evaporation from salt water is 10 per cent. less than from fresh water. From the Nile at Cairo the loss by evaporation is 3 mms. daily in winter (October to March), and 5·3 mms. in summer (April to September). In the neighbourhood of the Great Lakes there is no evaporimeter, and although it is difficult to calculate from meteorological conditions the amount of evaporation, 3 mms. per day may be taken as a fair estimate of the evaporation from Lake Victoria. No reliable experiments have been made concerning the evaporation from irrigated land.

Overweg's Grave.—The following account of the finding of Overweg's grave has been communicated to us by Mr. W. P. Hewby :—"Dr. Overweg is reported by Barth to have died in Bornu on September 27, 1852, at Maduari, on the western Chad marshes. On the British occupation of Bornu, in 1902, inquiries were made for the sites of the graves of Overweg and of Mr. Richardson, who died a year and a half earlier, but no information thereupon could be obtained. Continued inquiries meeting with the same result, it became evident that the people entertained some fear that the acknowledgment might prove detrimental to themselves. In October, 1909, the Resident of the province succeeded in overcoming their fears, and obtained the following information. The Kanembu village of Maduari of Barth's day was then on its second site within history, and was subsequently moved another three-quarters of a mile to the westward, to its present site, on account of the inroads of Chad. While the present village is well shaded, the only tree left standing on the last site is the gnarled old karaga under which Overweg was buried. The search for the grave was without result until an old woman among the bystanders said, 'If you sit on this root, and extend your foot, it will touch the white man's grave.' This was found to be an almost accurate statement, and the grave was unmistakable, though the remains proved to be small. It was thought best to remove them to the modern Bornu capital at Maiduguri, where they were interred on October 29 in the European cemetery. The photographs show the Maiduguri graveyard and scenes at the exhumation, the three figures at the grave-head being the present 'Fugu' of Maduari, the son of Fugu Arri (the friend of Barth and Overweg), and the son of the old woman whose compound in the 'fifties adjoined the tree. Mr. Richardson's grave at Ngurutua, not far from the present station of Geidam, has not yet been located. It is, perhaps, worth recalling the fact that Abega, the trusty servant of the travellers, who attended Overweg during his last days, and who afterwards accompanied Barth to Europe, is to-day chief of the native town of Lokoja, on the River Niger, while his grandson has for years been an interpreter in the Government service in Bornu."



THE GRAVEYARD AT MAIDUGURI, BORNU.



OVERWEG'S GRAVE AT MADUARI, BORNU

A Population Study of French Guinea.—Estimates of population in the more newly opened regions of Africa with any claim to exactness are still so few that a study of the distribution of population, by circles, in French Guinea is of considerable interest. It is supplied in *L'Afrique Française* for December, 1909, by Captain Salesses, well known for the important part he has played in connection with railway development in French Africa. The area of each circle has been obtained by planimeter, the population figures being those arrived at by the administration with a view to the collection of the capitation tax; and it is pointed out that though some facilities for evading payment exist, while a considerable interchange of inhabitants takes place between the circles and with neighbouring colonies, the figures may be taken as generally representing the facts. A map is given in which the number of inhabitants per kilometre, as calculated from the above data, is shown for each circle, and this supplies a means of estimating broadly the relative resources of the different circles. For the whole colony the mean density is from 7 to 8 per square kilometre (18 to 20 per square mile), but the figure varies in individual circles from 2·58 to 40. There are three main foci of population, one on the coast, another running north and south through Futa Jallon, the third along the northern Liberian frontier, both of the last two being elevated tracts, whence it appears that, except on the coast, population generally avoids the lowlands. Captain Salesses thinks that the grouping of population should to some extent be a guide to future railway extension.

Dr. Pöch's Travels in the Southern Kalahari.—Dr. Rudolf Pöch's South African explorations beyond the Kalahari were brought to a conclusion by new and fruitful studies of Bushmen engravings on the eastern edge of the desert, more particularly the "footprints" at Machen (near Mochudi), and the geometric figures, which the explorer interprets as conventionalized copies of nature. He further studied the Griquas, the Korannas (Hottentot tribes), and, above all, the last remains of the Cape Bushmen, the Kham People. In the western districts of Cape Colony he found among them the best types of Bushmen encountered by him throughout the whole course of his journey. The bodily stature of all the men was between 4 feet 8 inches and 4 feet 10 inches. Two women measured 4 feet 5 inches and 4 feet respectively. Other individuals, however, showed a distinct admixture of Hottentot blood. This mixture must have been effected before the immigrant Europeans began to drive the peoples before them and to mingle them together. To complete his studies of Bushman life, Pöch started on a fresh journey into the Kalahari on July 11, 1909. His road led from Upington on the Orange river, going first in a north-easterly direction as far as the south-east edge of the sandfield at the Lange and Koranna mountains, and thence following for the most part the waterless river-channel of the Karuman and Nosof, ten days' continuous journey without water. Being quite a moist year, the food-supply could be supplemented by water-melons, but in dry years even these are not forthcoming. Near Upington the traveller came upon Bushmen of a type allied to that of the Kham people, but throughout the rest of the way most of the families had migrated north. No others were encountered till the Nosof valley was reached, and these already showed a closer approximation to the Kalahari Bushmen. This confirmed an observation made as far back as at Mafeking, viz. that the waterless valley of the Molopo, running east and west, is to be taken as the approximate boundary between the Kalahari and the Cape (or Kham) Bushmen. These latter approach much nearer the original type, but most of them have perished in the hopeless effort to defend their hunting-grounds. In 25° 40′ S. the traveller approached the frontiers of German South-West Africa, and here he came on representatives of the tribe first studied by him the year before, a little further north. Hence the expedition returned southwards to

Rietfontein-South (the English mission-station close to the German frontier), and thence went south-east to Upington. Unlike the middle Kalahari, the southern Kalahari is not a plain, but the sand is piled up into dunes which run almost without exception north-north-west and south-south-east, and in the west form a miniature mountain chain rising to a height of 160 feet. Elsewhere the dunes vary from a few metres up to 30 or 60 feet, and consist of loose red sand overgrown with grass and low brushwood, contrasting with the sand of the valley, which is often greyish-white. Pans are here particularly numerous. Oval depressions with hard bare floor, or thickly incrustated with salt, they differ essentially from the limestone-pans in the more northern formations. The journey, which covered about 1000 miles, was brought to a close at Cape Town early in December.

Minerals of Nyasaland.—A second Report by Prof. W. Dunstan, on the results of the Mineral Survey in 1907–8, has been issued by the Colonial Office, accompanied by a sketch-map. Coal in the neighbourhood of Nyasa lake occurs in sedimentary deposits of Karroo age, and often associated with limestone. Usually bituminous, it approximates in some cases nearer to lignite. The best bituminous coal is from Mount Waller. It is available as fuel for any purpose, as also for the production of coke and gas. Easily workable, it is a highly valuable asset to the Protectorate. Its seams, several feet thick, occur close to and above Lake Nyasa, and probably extend under the lake. An inferior, but generally serviceable, coal occurs in the Nkana district, too far from the lake to be immediately available. Near the North Rukuru river there is coal of fair quality as fuel; but at Lufira it is too shaly to be of much value. There is coal also at Kasante, but unsatisfactory on account of its friableness. Thus in Nyasaland there is coal only awaiting the demand for fuel which must follow the development of railway and lake transport. Besides the serviceable limestones referred to in the previous Report, others, now described, would furnish good mortar and be useful agriculturally. Gold, detected in small quantities, seems to be nowhere in sufficient quantity to repay working, though that found near Fuliwa, a few miles from the northern shore, calls for investigation.

AMERICA.

Marsh and Pond Vegetation on the Northern Coast of New Jersey.—In the *Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. 61, Part II., 1909, Mr. John W. Harshberger discusses the vegetation of the marshes, salt- and fresh-water ponds found along the northern coastal region of New Jersey. These ponds have been overlooked in the works that have been published upon the physiography of New Jersey, but they are nevertheless important features, and may be designated as salt or fresh according as whether they are closed or open to the ocean. They have all had essentially the same history, having been brought into being by the obstructive action of travelling sand beaches upon sluggish streams flowing down seawards from the interior. The Hudson river has succeeded in breaking through these sand-dunes, but all along the east coast of America, from Long island to Florida, there is a constant struggle for supremacy between sand and water. Most of the larger streams that have managed to keep their outlets open to the sea are lined for some distance inland by salt marsh vegetation showing a characteristic association of plants. Where sand-bars have encroached upon the mouths of the rivers the water has become more brackish, and with the altered physiographical conditions the vegetation has changed accordingly, till in several of the smaller ponds one finds only the plants accustomed to grow in or near fresh-water streams. The vegetation of the New Jersey coast, therefore, is not of a fixed type, and by a comparison of the several plant formations in various phases of development it is possible to trace the stages through which the vegetation has passed, and

to determine the age of the different plant associations by reference to past and present survey-maps exhibiting the marsh areas. The progressive development from original salt marsh vegetation to fresh-water and dry land flora is the orderly sequence of events, but now and then sudden reversals of the process occur when the sea in high tides or storms breaks through the sand-barriers. The greatest changes, however, in the vegetation of northern coastal New Jersey have been due to man, who has cut down forests, spanned rivers with bridges, thereby disturbing their natural flow, built roads, constructed jetties, drained ditches, spread kerosene over marshes to destroy mosquitoes, and so altered natural conditions that in some places there is no trace of original vegetation left.

Captain Whiffen's Journey in the Amazon Basin.—Captain T. W. Whiffen has lately returned from an expedition to the upper waters of the north-western tributaries of the Amazon, in the course of which he traversed ground of which very little has hitherto been known. Starting in May, 1908, from Manaos, at the mouth of the Rio Negrò, and failing to find facilities for the ascent of the Uaupés (the most important headstream of that river), he proceeded to the Napo, and eventually made his way to the Isa (Içca), Yapura, and Apaporis, collecting geographical and other data *en route*. He paid special attention to the ethnology of this region, the natives of which are frankly anthropophagous on occasion, are ignorant of the use of metals, and have not yet awaked to the conveniences of barter. On the other hand, they are monogamous, cleanly, and peace-loving within the limits of their own tribes. Captain Whiffen brought back a considerable ethnographic collection, with vocabularies, photographs, and measurements of native types, weapons, and implements, etc. He also made a map of the region traversed. He was able to obtain information as to the fate of the French explorer, Eugène Robuchon, who was killed by Indians near the mouth of the Cahuinari river about March, 1906, and whose collection of native ornaments is to be found in the British Museum. For this service Capt. Whiffen has received the thanks of the French Government.

AUSTRALASIA AND PACIFIC ISLANDS.

The British Expedition to Western New Guinea.—Writing early in the year from Wakatimi, on the Mimika river, in Dutch New Guinea, Captain Rawling gives some account of the experiences of this expedition (*Journal*, vol. **33**, p. 93; vol. **34**, pp. 91, 458) since reaching its field of action. From Java the expedition had been transported in a steamer lent by the Dutch Government to Dobo (Aru islands), and thence to the final landing-place at the mouth of the Mimika river. This has a bad bar, across which the steamer could not pass; but the ship's launch enabled the party to steam up to the large village of Wakatimi, the natives proving friendly. A clearing was made and a camp formed; but delay was then caused by the want of a launch in which to ascend the river—a fine stream 120 yards wide and 15 feet deep, with a 2-mile current. Efforts were being made to obtain one from the Dutch Government, for the transport of all the men and stores to the foot of the mountains by means of canoes would be an impossibility, though attempts were to be made to prospect up-stream. Captain Rawling gives details as to the sad occurrence which involved the death of Mr. Stalker, alluded to in the March number. On January 9 he had gone shooting in the dense jungle alone. At nightfall he had not returned, but nothing could be done, for the night was intensely dark, and it was raining in torrents. The whole camp turned out in the morning, cutting paths through the dense bush; but not till the 12th was Mr. Stalker's body found by natives in a creek. He had apparently lost his way and become delirious, but the actual cause of death was probably drowning. The

land around is described as flat, with dense vegetation, and only at two points could a distant glimpse of the hills be obtained. No natives had been met with except at Wakatimi.

The Gilbert and Ellice Islands.—A Parliamentary report issued in January (Cd. 4992) contains some interesting information on the present condition of these archipelagoes, in the form of a report by Mr. Arthur Mahaffy, Assistant to the High Commissioner for the Western Pacific, on a visit of inspection made by him last year. After pointing out the obstacles to progress existing in the past owing to the quarrelsome nature of the inhabitants and the almost permanent state of war on most of the larger islands, Mr. Mahaffy pays a warm tribute to the work done by the late Resident Commissioner, Mr. W. Telfer Campbell, through whose efforts, mainly, this state of things has completely changed. The islands are now kept in the most perfect order, trees are being planted, land is being reclaimed, and every man is secure from spoliation by his more powerful neighbours. In spite of the long intervals between visits of inspection which have occurred in the past, the native officials have done their duty well and truly, and with an honesty (in the case of those who have charge of considerable sums of money) as remarkable as it is admirable. Some aspects of the advance of civilization are not altogether matters for congratulation. Thus the establishment of the great labour centre near by, on Ocean island, has led to the adoption of inartistic European articles, and there has been a rapid decline in the native arts and crafts. Mr. Mahaffy sketches in a striking manner the difference between the conditions of life in these low coral islands and those in such groups as the Solomons or New Hebrides. Intercommunication between the islands is much hampered by the strength of the equatorial current, which, from the danger it causes to canoes, has even necessitated the prohibition of inter-island voyages, except in the trading steamers; and the results of this isolation are to be seen in the character of the race. It is to be regretted that the islands offer no exception to the decrease of population everywhere prevalent in the Pacific. Imported diseases, the wearing of unsuitable clothes, the increase of phthisis, and other agencies are mentioned as causes, together with the increasing number of sterile marriages, which threaten to depopulate several of the islands. At present the output of copra, the sole article of export, is restricted by the great local consumption of coconuts. But with the progress of depopulation the amount may be largely increased in the future.

POLAR REGIONS.

A German Antarctic Expedition.—To the projects already announced for renewed exploration in the Antarctic regions must now be added one originated in Germany. The leader of the proposed expedition will be Lieut. Filchner, whose explorations in the little-known borderlands of north-eastern Tibet are well known to readers of the *Journal*. At the meeting of the Berlin Geographical Society on March 5, under the presidency of Prof. Penck, Lieut. Filchner outlined his proposals for the carrying out of the project. His idea is to start from a base on the Weddell sea, on the opposite side of the Antarctic area to that which recent and proposed British expeditions have adopted, and to endeavour to make his way across the supposed South Polar continent to the Ross sea. At the same time, a subsidiary expedition will start from the side of the latter sea, and advance, probably by Sir E. Shackleton's route, about half way to the pole, leaving a *depôt* of provisions for the use of the main expedition at the farthest point reached, and then turning back. Lieut. Filchner will pay especial attention to the problem of the possible division of the Antarctic land-mass into two by an arm of the frozen sea. He disclaims all intention of trespassing on the field of action of the

forthcoming British and American expeditions (the latter of which, as noted in the March number, will also make its base on the side of the Weddell sea), for while these will probably concern themselves with the more elevated part of the Antarctic continent, he proposes to cross its lower portion. The expedition will not start till 1911.

OBITUARY.

Colonel Claude Reignier Conder, R.E., LL.D.

THE name of Colonel Conder, who died at Cheltenham on February 16, is one that will never be forgotten by those who take an interest in the topography and history of Palestine, as there has been no man who has done more by his work in the country, and by his studies, to throw light upon the many problems connected with the Holy Land.

Conder, who was the son of the late F. R. Conder, Esq., M.I.C.E., was born on December 29, 1848, and, after completing his education at University College, London, and the Royal Military Academy, Woolwich, received his first commission in the Royal Engineers on January 8, 1870. While going through the course of instruction for young officers at Chatham, he displayed such an aptitude for surveying and archæology that, on the completion of the course, the Committee of the Palestine Exploration Fund applied for his services in connection with the survey of the Holy Land, west of the river Jordan.

This Society, which was founded in 1865, in order to carry out a scientific examination of Palestine, had made preliminary surveys under the late General Sir C. Wilson, and important explorations at Jerusalem under General Sir C. Warren, but it soon became evident that the first step to effective work was to make a thoroughly accurate survey on a sufficiently large scale to show all the natural and artificial features of the country.

The necessary permission was obtained from the Sultan, and, in October, 1871, a party of Royal Engineers, under the command of Captain Stewart, R.E., landed at Jaffa, and commenced work. After a short time Stewart was unfortunately taken seriously ill, and was invalided home; and in June, 1872, Lieut. Conder was selected to succeed him. It was an arduous and responsible task for so young an officer, but the admirable manner in which he carried it out showed that the choice was a very wise one. He was at first assisted by the late Mr. C. Tyrwhit Drake, who died of fever in 1874, and then by Lieut. Kitchener, R.E., now Viscount Kitchener of Khartum. The greater part of the work had been completed in July, 1875, when a murderous attack upon the survey party, in which both Conder and Kitchener were seriously injured, caused a temporary delay.

As soon as he had recovered, Lieut. Conder returned to England, and the work of preparing the map for publication on the scale of 1 inch to the mile, and of editing the enormous mass of plans and other information which had been collected, was taken in hand. This occupied nearly three years, until April, 1878; the portion of the field work which had been left unfinished being completed by Kitchener in 1877. The map was printed by the Ordnance Survey, and issued in 1880, accompanied by seven volumes of memoirs, containing information about Palestine of the fullest description, and of the greatest value to the Bible student.

After completing his work in connection with the survey of Western Palestine,

Lieut. Conder was stationed at Edinburgh for three years, where he was employed on the construction of new works of fortification for the defence of the Firth of Forth. He again returned to Palestine in March, 1881, having been requested by the Committee of the Palestine Exploration Fund to carry out a survey of the country east of the Jordan. This proved a difficult task, as the Turkish local authorities refused to recognise the authority which had been given by the Porte for the previous survey, and stopped the work. But Conder succeeded in mapping about 500 square miles of country, and in collecting a great deal of valuable topographical and archæological detail, which, with the map, were published by the Palestine Exploration Fund.

On his return to Jerusalem from the east of Jordan, Conder, who had been promoted captain in January, 1882, was asked to accompany Their Royal Highnesses the Princes Albert Victor and George of Wales on their tour through Palestine, and his intimate knowledge of the country made him an admirable guide. The royal party visited the tombs of the Patriarchs at Hebron, which, though closed to Christians, were shown by order of the Sultan, and travelled all through the country, inspecting everything of interest, under the guidance of Captain Conder.

On the outbreak of the Egyptian war in July, 1882, he was selected for employment on the staff of the Intelligence Department; and, landing at Ismailyeh in August, was present at the battles of Kassassin and Tel-el-Kebir, and the advance to Cairo. Here he was taken seriously ill with typhoid fever, and was invalided home.

Captain Conder was then again employed in London in completing the records of the Palestine surveys, and, after being stationed for a short time at Chatham, was ordered to South Africa for employment under General Sir C. Warren in the Bechuanaland expedition, as Deputy Assistant Adjutant-General. There he did excellent work in the Intelligence Department, and on the survey of Bechuanaland, and was honourably mentioned for his services.

After returning from South Africa, Conder was stationed at Chatham in command of a company of the Royal Engineers, and, in 1887, was appointed to the Ordnance Survey at Southampton, where he remained until 1894, when he was ordered to Ireland for work in connection with the defences at Berehaven. He was also employed on the Irish relief works in 1895, and received the thanks of the Government for the assistance that he rendered with regard to them.

Conder was promoted Lieut.-Colonel in 1895, and was appointed Commanding Royal Engineer at Weymouth, and was in charge of the extension of the fortifications of Portland. This post he held for five years, and then went on half-pay as a brevet-colonel, but was again employed on the Ordnance Survey in Ireland. He retired from the service in November, 1904.

Besides the Memoirs already referred to, written in connection with the Survey of Palestine, Colonel Conder was the author of many other works dealing with the geography, history, and archæology of Palestine. It is sufficient to give the names of these to show the scope and great extent of his researches. They include:—'Tent work in Palestine,' 1878; 'Judas Maccabæus and the Jewish War of Independence,' 1879; 'Handbook to the Bible,' 1879; 'Heth and Moab,' 1883; 'Altaic Hieroglyphs,' 1887; 'Primer of Bible Geography,' 1884; 'Palestine,' 1889; 'The Tell Amarna Tablets,' 1893; 'The Bible and the East,' 1896; 'The Latin Kingdom of Jerusalem,' 1897; 'The Hittites and their Language,' 1898; 'The Hebrew Tragedy,' 1900; 'The First Bible,' 1902; 'Critics and the Law,' 1907; 'The Rise of Man,' 1908; 'The City of Jerusalem,' 1909.

Besides the above, he contributed a large number of valuable papers to the

Quarterly Statement of the Palestine Exploration Fund from 1872 up to the present time, his last article, on "Recent Hittite Discoveries," appearing in January 1910, only a month before his death. He also contributed to the publications of the Palestine Pilgrim Texts Society, and to various encyclopædias and dictionaries dealing with Palestine and the Bible.

Colonel Conder was a man of great knowledge and varied attainments, and his death will be much felt, not only by his personal friends, but by the readers of his valuable works.

CORRESPONDENCE.

The Altitude of Mount Huascaran.*

February 15, 1910.

In 1908 Miss A. Peck, of U.S.A., claimed to have ascended the north lower summit of Mount Huascaran in Peru. She made no instrumental observations above what she considers to be an altitude of 5975 metres, 19,600 feet, but, from eye-estimates only, asserted that this peak had a height of at least 7317 metres, 24,000 feet, and was thus the highest mountain of South America.

Believing Aconcagua to be the highest Andean peak, and furthermore to test the truth of these assertions, I decided to have a careful detailed triangulation made of the two summits of Mount Huascaran. Through the assistance of Messrs. Fr. Schrader and Henri Vallot, acting for the Société Générale d'Études et de Travaux Topographiques of Paris, an expedition was sent to Peru for me under the direction of M. de Larminat to effect this purpose.

Assisted by the Peruvian Government and favourable weather, M. de Larminat and his assistants were able to carry out this work successfully between August and November, 1909. A base 1600 metres (5248 feet) long, was measured in the Rio Santa valley in the Black Cordillera at an altitude of 3800 metres (12,464 feet). This base was measured by means of a 50-metre (164-feet) tape, of Invar metal. From two stations, one at either end of this base, and from two others, the positions and altitudes of which were determined by trigonometrical measurements from them, that is from four stations in all, the positions and relative altitudes of the two summits of Huascaran were fixed by azimuthal and zenithal angles taken by theodolite.

In order to ascertain the true height of these stations above average sea-level, a progressive leveling was conducted from the highest station, called the Garganta Signal down along the mule-path leading from Yungay by way of Quillo to the sea at the port of Casma. The Garganta Station is higher than the col where the path between Yungay and Cosma reaches its highest point. The difference in height between these two was ascertained by triangulation from the Garganta Signal to be 159 metres (521·5 feet). From the col down to sea-level at the port of Casma, the leveling was performed by means of the tacheometer. The altitude of the Garganto Signal being thus established, it was an easy matter to fix the altitude of the other three stations, from which the triangulation of the summits was made. From two of these stations from which it was visible, the altitude of the church tower at Yungay was also established at 2568 metres (8432 feet).

The average sea-level was determined by four double observations of two water-marks made at intervals of six hours ten minutes between each. The agreement of

---

* See p. 199.

these was satisfactory owing to the small amplitude of the tide at Casma, and also to the fortunate circumstance that the observations were made at time of neap tide.

The results of these measurements show the height of the north peak of Huascaran to be 6650 metres (21,812 feet), and the height of the south peak, 6768 metres (22,182 feet).

FANNY BULLOCK WORKMAN.

Mesopotamian Trade—Noah's Flood—The Garden of Eden.

Bagdad, February 14, 1910.

I have just received the *Journal* for January 1, and find a slight inaccuracy in the statement attributed to me at the end. I did not say that the merchandise of Mesopotamia went through Aleppo, but that "the merchandise of Northern Mesopotamia went through Aleppo, while the merchandise of Southern Mesopotamia or Babylonia and the regions to the East went through Tyre and Sidon."

I should also like to say that, not having space, I compressed too much what I had to say about the location of the flood, but subsequent correspondence with people interested in the question has encouraged me in adding it in the correspondence columns of the *Journal*.

"That the region to the south of Ur of the Chaldees is probably the spot where the ark landed is further proved by two facts:—

"(1) A vessel drifting down the Euphrates with the current and wind from the north and north-west would at Ur of the Chaldees meet the strong current of the ancient Tigris coursing down from the north, and would be driven ashore somewhere near the junction of the two rivers.

"(2) When at Ur of the Chaldees the other day we found that the Arabs called the mounds to the south of Ur of the Chaldees 'Nûawês.' Now, 'Nu' is the Arabic for Noah.

"That those primitive and early people whose records we possess in Genesis did truly think that the whole world was contained in the Euphrates-Tigris delta, and consequently destroyed by the flood, is proved by the only explanation they could find for the great influx of people into the valley from the surrounding countries once order began again to be established. They could attribute the multiplicity of languages which began to be spoken all at once to nothing but divine anger at their extraordinary high hopes and ambitions.

"I believe that history will repeat itself in our day, and once the works here are seriously undertaken the difficulty will not lie in finding labour, but finding means of getting work out of people who speak many languages and find it hard to work together."

W. WILLCOCKS.

30, Westbourne Villas, Hove,
February 23, 1910.

I am sorry I was not present when Sir William Willcocks delivered his lecture before the Royal Geographical Society in November, which appeared in the monthly *Journal* last month, as I might have said a few words regarding the ancient

sites of the Garden of Eden and the Ur of the Chaldees, which he places in the south instead of the north of Mesopotamia. I had some years ago lectured upon the position of those Biblical positions before the Victoria Institute and the Society of Biblical Archæology, and I then tried to prove that they were, according to ancient history, in the highlands of Armenia, and not in Southern Babylonia on the confines of the Persian gulf. It must be remembered that Mesopotamia of the Greeks is quite different from that of Biblical record, because the former embraced all the plain of what is known now in geography, whereas the Aram-Nahraim mentioned in Hebrew goes only as far as ancient Eddesa, known as Orfa, to the west of Nineveh.

We find that the Ur of the Chaldees was in Aram-Nahraim, in Northern Mesopotamia, and the Garden of Eden was in the highlands of Armenia, as we are told that two of the well-known rivers, the Euphrates and the Tigris, flow from the sacred river of Eden, situated in that locality.

With regard to the march of Artaxerxes and the ten thousand Grecian auxiliaries, and the battle which took place at a spot in Babylonia called Canoxa, I referred to them in the lectures I mentioned above before the Society of Biblical Archæology in 1884. If Sir William Willcocks is not able to obtain them, I shall be happy to lend them to him.

H. Rassam.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1909–1910.

Ninth Meeting, February 21, 1910.—Major Leonard Darwin, President, in the Chair.

Elections.—*Cecil Beckwith Cave-Browne-Cave; Major John F. Church; Major Timothy Fetherstonhaugh (late Seaforth Highlanders); Herbert John Fleure; Leland Harrison; Gordon Noel Humphreys; George C. Ishmael; Owen Letcher; Rev. John Campbell MacGregor; Loris Emmerson Mather; Batt.-Major L. Boyd Moss (South Staffordshire Regiment, Pretoria); Josiah Kingsley Ohl; Captain W. W. Pitt-Taylor, D.S.O. (Rifle Brigade); George Edwin James Rose; William Herbert Semmens; Rev. Arthur J. Spencer; Willard Dickerman Straight; Algernon H. P. Strickland; Captain Arnold Johnston Wolff, R.E.; Frank Wright.*

The paper read was—

"Explorations in and around Lake Chad." By Captain J. Tilho.

RESEARCH DEPARTMENT.

February 22, 1910.—Dr. A. Strahan in the Chair.

"Changes in the Course of the Cam since Roman Times." By the Rev. Archdeacon W. Cunningham.

"Experiments on Rate of Deposition of Matter in Water." By Dr. Owens.

Tenth Meeting, March 7, 1910.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*Murry Barford; Richard Kalish; Reginald Charles F. Maughan; Louis John de Milhau; G. W. von U. Searle; Stephane Kahn; Captain Thomas William Whiffen.*

The paper read was—

"Land and People in the Kasai Basin." By E. Torday.

Eleventh Meeting, March 14, 1910.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS—*Captain Thomas Sanderson Angus; Francis W. Chesnaye; Prof. Chester G. Fuson; Frank Gale; William Higgins; Archibald J. Laird; Du Pre P. Lance; Captain Cedric L. Longstaff (North Staffordshire Regiment); Commander Guy Montagu Marston, R.N.; Francis Davidson Outram; J. Owen; Captain George Percy Achilles Phillips, R.E.; Thomas Hogg Robertson; William Salmon; Major-General Theodore E. Stephenson, C.B.; Leo Tollemache (2nd Lincolnshire Regiment); G. J. F. Tomlinson.*

The paper read was—

"Exploring and Boundary Work in Bolivia." By Major P. H. Fawcett, R.A.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mittheilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo, quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic—Tide. *Sitzb. K.A.W. Wien*, Ab. IIa. 117 (1908): 151–208. **Sterneck.**

Das Fortschritte der Flutwelle im Adriatischen Meere. Von Dr. Robert v. Sterneck. *Maps and Illustrations.*

See note in vol. 33, p. 86.

Alps—Morphology. *Z. Ges. E. Berlin*, 1909: 387–395. **Brückner.**

Zur Frage der Entwickelung der Rhein-Rhone-Wasserscheide. Von Prof. Dr. Eduard Brückner.

Alps—Snow. *Sitzb. K.A.W. Wien*, Abt. IIa. 117 (1908): 1231–1249. **Defant.**

Schneedichtebestimmungen auf dem Hohen Sonnblick (3106 m.). Von Dr. A. Defant. *Diagrams.*

Balkan Peninsula—Phytogeography. **Adamović.**

Die Vegetation der Erde. Sammlung pflanzengeographischer Monographien herausgegeben von A. Engler und O. Drude. XI. Die Vegetationsverhältnisse der Balkanländer (Mösische Länder) umfassend Serbien, Altserbien, Bulgarien, Ostrumelien, Nordthrakien und Nordmazedonien. Von Prof. Dr. Lujo Adamović. Leipzig: W. Engelmann, 1909. Size 10 × 7, pp. xvi. and 568. *Maps and Illustrations. Price* 40*m.*

Crete—Historical. **Hawes.**

Crete, the forerunner of Greece. By Charles Henry and Harriet Boyd Hawes, with a preface by Dr. A. J. Evans. London, etc.: Harper Bros., 1909. Size 7 × 4½, pp. xiv. and 158. *Plans. Price* 2*s.* 6*d. net. Presented by the Publishers.*

See Review, *ante*.

France—Ports. **Rousiers.**

Paul de Rousiers. Les grands ports de France; leur rôle économique. Paris: A. Colin, 1909. Size 7½ × 5, pp. xlvi. and 260. *Price* 3 *fr.* 50. *Presented by the Publisher.*

Iceland. **Grumbkow.**

Ísafold: Reisebilder aus Island. Von Ina von Grumbkow. Berlin: D. Reimer, 1909. Size 9½ × 6, pp. xxiv. and 202. *Map and Illustrations. Price* 6*m. Presented by the Publisher.* [See notice in the March number, p. 321.]

Italy—Bologna. **James.**

Bologna: its history, antiquities, and art. By Edith E. Coulson James. London: H. Frowde, 1909. Size 9 × 5½, pp. xxviii. and 410. *Plans and Illustrations. Price* 12*s. net. Presented by the Publisher.*

Italy—Rome. **Lanciani.**

Wanderings in the Roman Campagna. By Rodolfo Lanciani. London: Constable & Co., 1909. Size 9½ × 6½, pp. xiv. and 378. *Sketch-maps and Illustrations. Price* 21*s. net. Presented by the Publishers.*

Russia—Ural. **Duparc and others.**

Recherches géologiques et pétrographiques sur l'Oural du Nord. Le bassin de la Haute Wichéra. Par Louis Duparc; avec la collaboration . . . de Francis Pearce et de Marguerite Tikanowitch. 3e partie. (Extrait des *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève*, vol. 36, Fascicule 1.) Geneva, 1909. Size 12 × 9, pp. 31–210. *Map and Illustrations. Presented by Prof. L. Duparc.*

Switzerland. **Webb.**

Switzerland of the Swiss. By Frank Webb. London: Sir I. Pitman & Sons, 1909. Size 7½ × 5½, pp. x. and 254. *Illustrations. Price* 6*s. net. Presented by the Publishers.*

Turkey—Albania. **Liebert.**

Aus dem nordalbanischen Hochgebirge. Von Dr. Erich Liebert. (Zur Kunde der Balkanhalbinsel . . . herausgegeben von Dr. Carl Patsch, Heft 10.) Sarajevo: D. A. Kajon, 1909. Size 9½ × 6, pp. vi. and 74. *Sketch-map and Illustrations. Price* 2.50*m.*

Turkey—Albania. **Steinmetz.**

Von der Adria zum Schwarzen Drin. Von Karl Steinmetz. (Zur Kunde der Balkanhalbinsel . . . herausgegeben von Dr. Carl Patsch, Heft 6.) Sarajevo: D. A. Kajon, 1908. Size 9 × 6, pp. 78. *Map and Illustrations. Price* 2.[illegible]*m.*

Turkey—Macedonia. **Struck**

Makedonische Fahrten. Von Adolf Struck. II. Die makedonischen Niederlande. (Zur Kunde der Balkanhalbinsel . . . herausgegeben von Dr. Carl Patsch, Heft 7.) Sarajevo: D. A. Kajon, 1908. Size 9 × 6, pp. vi. and 100. *Maps and Illustrations. Price* 2.50*m.*

The first part was noticed in vol. 30, p. 549.

United Kingdom. **Herbertson.**

The Elementary Geography. Vol. 7, The British Isles, by F. D. Herbertson. (The Oxford Geographies, edited by A. J. Herbertson.) Oxford: The Clarendon Press, 1909. Size 7¼ × 5, pp. 192. *Maps and Illustrations. Price* 1*s.* 9*d. Presented by the Publishers.*

United Kingdom—Cambridgeshire. **Hughes.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard). Cambridgeshire. By T. McKenny Hughes and Mary Caroline Hughes. Cambridge: University Press, 1909. Size 7¼ × 5, pp. xiv. and 272. *Maps and Illustrations. Price* 1*s.* 6*d. Presented by the Publishers.*

Perhaps the best volume of the series that has yet appeared.

United Kingdom—Cartography. **Reinhard.**

Zur Entwickelung des Kartenbildes der Britischen Inseln bis auf Merkators Karte vom Jahre 1564. Inaugural-Dissertation . . . von Walter Reinhard. Zschopau: F. A. Raschke, 1909. Size 8½ × 5½, pp. xii. and 156. *Map. Presented by the Author.*

Noticed at p. 445, *ante.*

United Kingdom—Cheshire. **Coward.**

Cambridge County Geographies (edited by F. H. H. Guillemard). Cheshire. By T. A. Coward. Cambridge: University Press, 1910. Size 7¼ × 5, pp. x. and 208 *Maps and Illustrations. Price* 1*s.* 6*d. Presented by the Publishers.*

United Kingdom—Geology. **Monckton and Herries.**

Geology in the field: the Jubilee volume of the Geologists' Association (1858–1908). Edited by H. W. Monckton and R. S. Herries. Parts I. and II. London: E. Stanford, 1910. Size 9 × 6, p. 432. *Sketch-maps, Sections, and Illustrations. Price* 5*s net each. Presented by the Publisher.*

United Kingdom—Ireland. *P.R. Irish A.* **27**, Ser. B. (1909): 193–234. **Adams.**

The Distribution of Lichens in Ireland. By John Adams. *Sketch-map.*

United Kingdom—Limnology. *P.R.S. Ser. B.* **81** (1909): 165–206. **West.**

The British Freshwater Phytoplankton, with Special Reference to the Desmid-plankton and the Distribution of British Desmids. By W. West and G. S. West. *Sketch-maps and Diagrams.*

United Kingdom—Scotland. *J. Scottish Met. S.* **15** (1909): 9–15. **Begg.**

The Influence of Topographical Conditions upon Climate in the East of Scotland. By the Rev. John S. Begg. *Diagram.*

United Kingdom—Scotland. *B.S.G. Lille* **52** (1909): 129–144. **Demangeon.**

Dans les Highlands d'Ecosse. Voyage de Glasgow à Edimbourg, par l'île de Skye. Par M. Demangeon. *Illustrations.*

United Kingdom—Scotland. **Peach and others.**

Memoirs of the Geological Survey of Scotland. The Geology of the Seaboard of Mid-Argyll, including the Islands of Luing, Scarba, the Garvellachs, and the Lesser Isles, together with the Northern Part of Jura and a Small Portion of Mull. By B. N. Peach, H. Kynaston, and H. B. Muff. With contributions from S. B. Wilkinson, J. S. Grant Wilson, J. B. Hill, A. Harker, E. B. Bailey, and petrological notes by J. S. Flett. Glasgow, 1909. Size 9½ × 6, pp. viii. and 122. *Illustrations and Diagrams. Price* 2*s.* 3*d.*

United Kingdom—Scotland—Loch Ness. **Wedderburn and Watson.**

P.R.S. Edinburgh **29** (1909): 619–647.

Observations with a Current Meter in Loch Ness. By E. M. Wedderburn and W. Watson. Size 10 × 7, pp. 619–647. *Diagrams and Illustrations. Also separate copy, presented by the Author. Price* 1*s.* 3*d.*

United Kingdom—Thames. **Belloc.**

The historic Thames. By Hilaire Belloc. ("The Heart of England Series." London: J. M. Dent & Co., 1909. Size 7 × 5, pp. 204. *Illustration. Price* 3*s.* 6*d. net. Presented by the Publishers.*

United Kingdom—Wales—Rivers. *Geol. Mag.* V. 6 (1909): 508–512. **Richardson.**

On River Development in Mid South Wales. By L. Richardson. *Sketch-map.*

United Kingdom—Wales—Wye Valley. *Geol. Mag.* V. 6 (1909): 490–492. **Richardson.**

Some Glacial Features at Aberedw in the Wye Valley, near Builth Wells. By L. Richardson. *Illustration and Diagram.*

ASIA.

Afghanistan. *National G. Mag.* 20 (1909): 788–799, 866–876. **Huntington.**

The Afghan Borderland. By Ellsworth Huntington. *Illustrations.*

Arabia. **Musil.**

Nord-Arabien, Vorbericht über die Forschungsreise 1908–9. Von Alois Musil. (Aus dem Anzeiger der phil.-hist. Klasse der K. Akademie der Wissenschaften, No. 19, 1909.) Vienna, 1909. Size 10 × 6½, pp. 18. *Sketch-map.*

Central Asia. *La G., B.S.G. Paris* 20 (1909): 137–154. **Stein.**

Exploration géographique et archéologique en Asie centrale (1906–1908). Par Dr. A. Stein. *Sketch-map.*

Central Asia—Turkestan. **Wood.**

Travel and sport in Turkestan. By Captain J. N. Price Wood. London: Chapman & Hall, 1910. Size 9½ × 6½, pp. xx. and 202. *Map and Illustrations. Price* 15*s. net. Presented by the Publishers.*

China—Lolos. *T'oung Pao* II. 10 (1909): 340–380, 399–444, 603–665. **Legendre.**

Far West Chinois. Races Aborigènes. Les Lolos. Etude ethnologique et anthropologique. Par Dr. A. F. Legendre. *Illustrations.*

China—Western Frontier. **Bacot.**

Dans les marches tibétaines. Autour du Dokerla; Novembre 1906—Janvier 1908. Par Jacques Bacot. Paris: Plon-Nourrit & Cie., 1909. Size 7½ × 5, pp. iv. and 218. *Map and Illustrations. Price* 3.50 *fr.*

M. Bacot's travels were referred to in vol. 32, p. 182.

Chinese Empire—Filchner Expedition. **Filchner.**

Wissenschaftliche Ergebnisse der Expedition Filchner nach China und Tibet 1903–1905. III. Bd. Karte der chinesischen Provinz Kan-su, herausgegeben von Wilhelm Filchner (pp. viii. and 82); VII. Bd. Katalog der Ausbeute an ethnographischen Gegenständen; China [Plates and descriptions]. Berlin: E. S. Mittler u. S., 1910. Size 10 × 7½. *Map and Illustrations, and separate Portfolios of Maps* (Nos. 1 and 2, size 24 × 20). *Presented by Lieut. W. Filchner.*

Chinese Empire—Tibet. **Hedin.**

Trans-Himalaya: Discoveries and adventures in Tibet. By Sven Hedin. 2 vols. London: Macmillan & Co., 1909. Size 9 × 6, pp. (vol. 1) xxiv. and 436; xviii. and 442. *Maps and Illustrations. Price* 30*s. net. Presented by the Author.*

Reviewed in the March number, p. 322.

India. **Koenigsmarck.**

A German Staff-Officer in India: being the impressions of an officer of the German General Staff of his travels through the Peninsula; with an Epilogue specially written for the English edition. By Count Hans von Koenigsmarck. London: K. Paul & Co., 1910 [1909]. Size 10 × 6½, pp. xiv. and 340. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

India—Assam. **Allen.**

Assam District Gazetteers. Vol. 10. The Khasi and Jaintia Hills, the Garo Hills, and the Lushai Hills. By B. C. Allen. Allahabad, 1906. Size 9 × 6½, pp. 150, 100, and 72. *Illustration. Presented by the Secretary for India.*

Japan. **Dautremer.**

Joseph Dautremer. L'empire japonais et sa vie économique. Paris: E. Guilmoto, [1910]. Size 9 × 5½, pp. 308. *Map and Illustrations. Price* 6 *fr. Presented by the Publishers.*

Korea. *J. College Sc. Imp. Univ. Tokyo* **26** (Art. 2) (1909): pp. 208. **Kotô.**
Journeys through Korea. By Prof. B. Kotô. *Maps, Sections, and Illustrations.*
An important contribution to our knowledge of Korea.

Malay Archipelago—Java. **Collet.**
L'île de Java sous la domination française. Essai sur la politique coloniale de la Monarchie et de l'Empire dans la Malaisie Archipélagique. Par Octave-J.-A. Collet. Publication faite sous les auspices de la Société Belge d'Études Coloniales. Bruxelles: Falk Fils, 1910. Size 10 × 6½, pp. xiv. and 558. *Sketch-maps and Illustration. Price* 10 *fr. Presented by the Publisher.*

Malay Archipelago—Sumatra. **Mosskowski.**
Auf neuen Wegen durch Sumatra: Forschungsreisen in Ost- und Zentral-Sumatra (1907). Von Max Mosskowski. Berlin: D. Reimer, 1909. Size 9½ × 6, pp. xviii. and 328. *Maps and Illustrations. Price* 14*m. Presented by the Publisher.*

Persia—Khorasan. *Travel and Exploration* **3** (1909): 129–136. **Sykes.**
A Pilgrimage to the Tomb of Omar Khayyam. By Major P. M. Sykes. *Sketch-map and Illustrations.*

Philippine Islands—Anthropogeography. **Berkusky.**
M. k.k. G. Ges. Wien **52** (1909): 325–394.
Zur Anthropogeographie und Wirtschaftsgeographie der Philippinen. Von H. Berkusky. *Sketch-maps.*

Philippine Islands—Minerals. **Smith.**
Department of the Interior. The Bureau of Science, Manila. The Mineral Resources of the Philippine Islands, with a Statement of the Production of Commercial Mineral Products during the year 1908. By Warren D. Smith. Manila, 1909. Size 10½ × 7½, pp. 50. *Sketch-maps and Illustrations.*

Russia—Siberia. *Met. Z.* **26** (1909): 114–118. **Woeikoff.**
Temperatur ostsibirischer Flüsse und eines Polarsees daselbst. Von A. Woeikow.

Siam. ———
Siam. General Report on the Operations of the Royal Survey Department, Season 1906–07. Bangkok, 1909. Size 13½ × 8½, pp. 74. *Maps and Illustrations.*

South-East Asia. *M. Seminars Oriental. Sprachen* **12** (1909): 1 Abt., 110–123. **Weiss.**
Von Bhamo nach Tengyuë. Von Fritz Weiss. *Map, Profiles, and Illustrations.*

Turkey. **Hoffmeister.**
Kairo-Bagdad-Konstantinopel: Wanderungen und Stimmungen. Von E. v. Hoffmeister. Leipzig, etc.: B. G. Teubner, 1910. Size 10 × 7, pp. x. and 262. *Map and Illustrations. Price* 8*m. Presented by the Publisher.*

Turkey—Asia Minor—Archæology. **Ramsay and Bell.**
The Thousand and One Churches. By Sir W. M. Ramsay and Gertrude L. Bell. London: Hodder & Stoughton, 1909. Size 9 × 6, pp. xvi. and 580. *Sketch-maps, Plans, and Illustrations. Price* 20*s. net. Presented by the Publishers.*

Turkey—Mesopotamia. *Z. Ges. E. Berlin* (1909): 423–439. **Sarre.**
Reise in Mesopotamien. Von Prof. Dr. F. Sarre. *Illustrations.*

Turkey—Palestine. **Masterman.**
Studies in Galilee. By Ernest W. Gurney Masterman. Chicago: University Press, 1909. Size 9 × 6, pp. xvi. and 154. *Sketch-maps and Illustrations. Price* $1. *Presented by the Publishers.*

AFRICA.

Africa—Boundaries. **Hertslet and others.**
The map of Africa by Treaty. By the late Sir E. Hertslet. Third edition; revised and completed to the end of 1908 by R. W. Brant and H. L. Sherwood. Three vols. London: Harrison & Sons, 1909. Size 10 × 6, pp. l. and 1354. *Maps: also separate Atlas* (size 15½ × 10½). *Price* £3. *Presented by the Foreign Office.*
Reviewed in the March number, p. 325.

Africa—Flies. **Austen.**
Illustrations of African blood-sucking flies, other than mosquitoes and tsetse-flies.

By Ernest Edward Austen. London: British Museum (Natural History), 1909. Size 10½ × 7, pp. xvi. and 222. *Illustrations. Presented by the British Museum (Natural History).*

Africa—Geological History. *La G., B.S.G. Paris* 19 (1909): 377–383. **Lemoine.**

Conclusions d'ordre géographique tirées de l'étude des Mollusques d'Afrique. Par Paul Lemoine. *Sketch-maps.*

Africa—German Colonies—Exploration. **Winkler.**

Z. Kolonialpolitik 11 (1909): 699–720.

Erforschungen, Erkundungen und Kämpfe in unsern afrikanischen Kolonien 1907–08. Von C. Winkler.

Africa—Granites. **Horwood and Wade.**

Geol. Mag. V. 6 (1909): 455–468, 497–507, 543–553.

The Old Granites of the Transvaal and of South and Central Africa. By Cuthbert Baring Horwood. With a Petrographical Description of the Orange Grove Occurrence. By Arthur Wade.

Algeria—Kabylia. *Globus* 96 (1909): 357–361. **Mielert.**

Eindrücke aus dem Kernlande der Kabylen Algeriens. Von Fritz Mielert. *Illustrations.*

Belgian Congo—Administration. **Tournay-Detillieux.**

Loi sur le gouvernement du Congo Belge: *résumé* complet des discussions. Par J. Tournay-Detillieux. London: Luzac & Co., 1909. Size 10½ × 7, pp. xliv. and 196. *Price 4s. 6d. Presented by the Publishers.*

See March number, p. 327.

Belgian Congo—Health. *B.S. Belge d'Études Col.* 16 (1909): 801–829. **Dryepondt.**

La question de l'acclimatation au Congo. Par Dr. Dryepondt.

British East Africa. **Patterson.**

In the grip of the Nyika: further adventures in British East Africa. By Lieut.-Colonel J. H. Patterson. London: Macmillan & Co., 1909. Size 8½ × 5½, pp. xiv. and 390. *Sketch-maps and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

British East Africa. **Playne and Gale.**

East Africa (British): its history, people, commerce, industries, and resources. Compiled by Somerset Playne; edited by F. Holderness Gale. London: The Foreign and Colonial Compiling and Publishing Co., 1908–9. Size 12 × 9½, pp. 444. *Sketch-maps and Illustrations. Presented by Somerset Playne, Esq.*

British East Africa—Game. **Berger.**

In Afrikas Wildkammern als Forscher und Jäger. Von Dr. A. Berger. Berlin: Paul Parey, 1910. Size 9½ × 6½, pp. xvi. and 432. *Sketch-maps and Illustrations. Price 16m. Presented by the Publisher.*

Egypt and Sudan.

Guide to Egypt and the Sûdân, including a description of the route through Uganda to Mombasa. 6th edition. London: Macmillan & Co., 1909. Size 7 × 4½, pp. xviii. and 178. *Maps and Plans. Price 5s. net. Presented by the Publishers.*

Eritrea. **Dainelli.**

Giotto Dainelli. In Africa (Lettere dall' Eritrea). Parte 2ª. Lungo le pendici dell' altipiano abissino e in Dancalia. Bergamo: Instituto Italiano d'Arti Grafiche, 1910. Size 10½ × 7½, pp. 202. *Illustrations. Presented by the Publishers.*

The first part was reviewed in vol. 32, p. 523.

French West Africa. **François.**

Le Gouvernement Général de l'Afrique Occidentale Française. Notice publiée par le Gouvernement Général à l'occasion de l'Exposition Franco-Britannique de Londres, rédigée par G. Francois. [Paris: E. Larose, 1908.] Size 10 × 6½, pp. 104. *Sketch-map and Illustrations. Price 3 fr.*

A useful summary, prepared in connection with the Franco-British Exhibition of 1908.

German East Africa and Kamerun. **Langheld.**

Zwanzig Jahre in deutschen Kolonien. Von Wilhelm Langheld. Berlin: W. Weicher, 1909. Size 9½ × 7, pp. xii. and 432. *Maps and Illustrations. Price 10m. Presented by the Publisher.*

German South-West Africa. *Z. Kolonialpolitik* 11 (1909): 417–465. **Seiner.**

Die wirtschaftsgeographischen und politischen Verhältnisse des Caprivizipfels. Von Franz Seiner. *Portraits and Illustrations.*

The Germans have adopted the term "Caprivizipfel" for the north-east projection of German South-West Africa.

German South-West Africa. **Schwabe.**

Im deutschen Diamantenlande: Deutsch-Südwestafrika von der Errichtung der deutschen Herrschaft bis zur Gegenwart (1884–1910). Von Kurd Schwabe. Berlin: E. S. Mittler u. Sohn, [1909]. Size 10 × 7, pp. xii. and 444. *Maps and Illustrations. Price* 10*m. Presented by the Publishers.*

Gold Coast. *J. African S.* 9 (1909): 1–19. **Rodger.**

The Gold Coast of To-day. By Sir John Rodger.

Italian Somaliland. *L'esplorazione Com.* 24 (1909): 10–17, 39–56. **Piazza.**

La Regione di Brava nel Benadir. Per Captain Giovanni Piazza. *Sketch-maps, Plan, and Illustrations.*

Italian Somaliland—Cape Guardafui. *J. African S.* 9 (1909): 59–72. **Baldacci.**

The Promontory of Cape Guardafui. By Giulio Baldacci.

Ivory Coast—Ethnology. **Delafosse.**

Rev. études ethnograph., Paris 1 and 2 (1908–09): passim.

Le peuple Siena ou Senoufo. Par Maurice Delafosse. *Map and Illustrations.*

Kamerun—Grass-lands. *Naturw. Wochenschrift* 8 (1909): 513–519. **Schultze.**

Beobachtungen über die Fauna und Flora der Grashochländer Kameruns. Von Arnold Schultze. *Illustrations.*

Kamerun—Volcanic Eruption. *Deutsches Kolonialblatt* 20 (1909): 628–633. ———

Der vulkanische Ausbruch des Kamerunberges. *Map.*

See paper by Lieut. Boyd Alexander in the *Journal* for July, 1909.

Liberia—Ethnology. *Deutsche Rundschau G.* 32 (1909): 1–11. **Fischer.**

Einiges über das interne Leben der Eingeborenen Liberias. Von Hans Fischer. *Sketch-map.*

Madagascar. **Leblond.**

La grande île de Madagascar. Par Marius-Airy Leblond. Paris: Ch. Delagrave, [1910]. Size 10 × 6½, pp. 320. *Map and Illustrations. Presented by the Publisher.*

Madagascar—Ethnography. **Grandidier.**

Histoire physique naturelle et politique de Madagascar. Publiée par Alfred Grandidier. Volume 4, Ethnographie de Madagascar, par Alfred Grandidier et Guillaume Grandidier. Tome I. Paris: Imprimerie Nationale, 1908. Size 12½ × 9½, pp. 712. *Maps. Presented by the Authors.*

Madagascar—Gold. *Rev. Madagascar* 11 (1909): 54–76. **Marquet.**

L'or à Madagascar. Par Marquet.

Mauritania. **Gruvel and Chudeau.**

A travers la Mauritanie occidentale (de Saint-Louis à Port-Etienne). Par A. Gruvel et R. Chudeau. Vol. 1. Paris: E. Larose, 1909. Size 10 × 6½, pp. 282. *Maps. Price* 10 *fr.*

Mauritania is now the official name for the French territory north of the Senegal.

Morocco. **Gleichen.**

Journal of our Mission to Fez (1909). By the Military Attaché [Colonel Count Gleichen]. London: Harrison & Sons, 1909. Size 9½ × 7, pp. 110. *Illustrations. Price* 2*s.* 6*d. net. Presented by the Publishers.*

Morocco—Rif. *B.S.G. Oran* 29 (1909): 367–392. **Becerra.**

La Région des Guelaya (Rif) et le chemin de fer de Melilla aux Mines des Beni-Bou-Ifrour. Par Manuel Becerra. *Facsimile and Map.*

Natal—Mines. **Gray.**

Colony of Natal. Report on the Mining Industry of Natal for the years 1907 and 1908. By C. J. Gray. Pietermaritzburg, 1909. Size 13 × 8, pp. 90. *Plans, Sections, and Diagrams.*

North Africa—Climatology. *Abh. k.k. G. Ges. Wien* **8** (1909): 1–143. **Leiter.**
Die Frage der Klimaänderung während geschichtlicher Zeit in Nordafrika. Von Dr. Hermann Leiter. Size 11 × 8, pp. 1–143. *Sketch-map and Diagrams. Also separate copy.*

North-West Africa—Draa. **Hachemi ben Mohammed.**
B.S.G. Oran **27** (1909): 150–160.
Etude sur l'Oued Draa supérieur. Par El Hachemi ben Mohammed.

Portuguese East Africa—Zambesi. **Maugham.**
Zambesia: a general description of the valley of the Zambesi river, from its delta to the river Aroangwa, with its history, agriculture, flora, fauna, and ethnography. By R. C. F. Maugham. London: J. Murray, 1910. Size 9 × 5½, pp. xiv. and 408. *Map and Illustrations. Price* 15*s. net. Presented by the Publisher.*

South Africa. **Brown.**
The guide to South Africa . . . edited annually by A. Samler Brown and G. Gordon Brown, for the Union-Castle Mail Steamship Company, Ltd. 1909–1910 (17th edition). London: S. Low & Co., [1909]. Size 7½ × 5, pp. xlii. and 478. *Maps and Plans. Price* 2*s.* 6*d. Presented by Messrs. Donald Currie & Co.*

South Africa—Basutoland. **Lagden.**
The Basutos: the mountaineers and their country. Being a narrative of events relating to the tribe from its formation early in the Nineteenth Century to the present day. By Sir Godfrey Lagden. 2 vols. London: Hutchinson & Co., 1909. Size 9 × 5½, pp. xvi., xii., and 690. *Map and Illustrations. Price* 24*s.*

South Africa—Irrigation.
Cape of Good Hope. Proceedings of the First South African Irrigation Congress held at Robertson, Cape Colony, on the 18th May, 1909. Cape Town, 1909. Size 12 × 8½, pp. 100. *Presented by the Commissioner of Public Works.*

Spanish Guinea. *Rev. G. Col. y Mercantil* **6** (1909): 241–259. **García.**
Guinea Española. Exploraciones y estudios de los misioneros. Di León García.

Transvaal—Meteorology. *J. Scottish Met. S.* **15** (1909): 16–23. **Innes.**
Meteorology in the Transvaal. By R. T. A. Innes. *Illustrations and Diagrams.*

Transvaal—Rainfall. *J. Scottish Met. S.* **15** (1909): 24–29. **Wood.**
The Intensity Distribution of Rainfall over the Witwatersrand. By H. E. Wood. *Diagrams.*

Transvaal—Temperature. *Trans. R.S. South Africa I.* (1909): 127–128. **Innes.**
Transvaal Sea-level Temperatures. By R. T. A. Innes. *Sketch-maps.*

Tripoli. *B.S.G. Marseille* **33** (1909): 17–36. **Mathuisieulx.**
La Tripolitaine. Par M. de Vicomte H. Méhier de Mathuisieulx.

Tropical Africa—Forests. *C.R.A. Sc. Paris* **149** (1909): 458–461. **Chevalier.**
L'extension et la régression de la forêt vierge de l'Afrique tropicale. Par Aug. Chevalier.

Tropical Africa—Vegetation. *C.R.A. Sc. Paris* **149** (1909): 134–136. **Chevalier.**
Les tourbières de rochers de l'Afrique tropicale. Par Aug. Chevalier.
Describes the part played by a Cyperaceous plant in promoting the forestation of rocky plateaus.

Uganda and Sudan. **Dickinson.**
Lake Victoria to Khartum with rifle and camera. By Captain F. A. Dickinson. London: John Lane, 1910 [1909]. Size 9 × 6, pp. xx. and 334. *Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

Uganda—Ruwenzori. *T. Zoological S.* **19** (1909): 1–100. **Woosnam.**
Zoological Results on the Ruwenzori Expedition, 1905–1906. By R. B. Woosnam. *Illustrations and Sketch-map.*

West Africa. *Petermanns M.* **55** (1909): p. 229. **Frobenius.**
Vorläufige ethnographische Ergebnisse der Deutschen Innerafrikanischen Forschungsexpedition 1907–09. Von Leo Frobenius. *Map.*

West Africa—Boundary Expedition. *Le tour du monde* **15** (1909): 421–444. **Melin.**
Dans la Région du Tchad avec la Mission Tilho. Par L. Roserot de Melin. *Sketch-map and Illustrations.*

West Africa—Boundary Expedition. **Molin.**

Deutsches Kolonialblatt **20** (1909): 624–628.

Von der Yola-Crossschnellen Grenzexpedition. *Sketch-map.*

West Africa—Historical. **Lang.**

The land of the golden trade (West Africa). By John Lang. ("Romance of Empire" Series.) London: S. C. & E. C. Jack, 1910. Size 8½ × 6, pp. xii. and 316. *Sketch-maps and Illustrations. Price* 6*s. net. Presented by the Publishers.*

West Africa—Trade-routes. *G.Z.* **15** (1909): 520–530. **Kürchhoff.**

Alte und neue Handelsstrassen und Handelsmittelpunkte in West-Afrika. Von D. Kürchhoff.

NORTH AMERICA.

Alaska. *U.S. Geol. Surv. B.* **379** (1909): pp. 418. **Brooks and others.**

Mineral Resources of Alaska. Report on progress of investigations in 1908. By Alfred H. Brooks and others. *Maps, Sections, and Diagrams.*

Alaska. *U.S. Geol. Surv. B.* **374** (1909): pp. 104. **Moffit and Maddren.**

Mineral Resources of the Kotsina-Chitina Region, Alaska. By Fred H. Moffit and A. G. Maddren. *Sketch-maps, Diagrams, and Illustrations.*

Alaska. *U.S. Geol. Surv. B.* **375** (1909): pp. 52. **Prindle.**

The Fortymile quadrangle. Yukon-Tanana Region, Alaska. By L. M. Prindle. *Maps and Illustrations.*

Alaska. *B. American G.S.* **41** (1909): 601–610. **Stefánsson.**

Northern Alaska in Winter. By V. Stefánsson.

America—Pacific Coast. **Enock.**

The great Pacific Coast: twelve thousand miles in the Golden West. Being an account of life and travel in the Western States of North and South America, from California, British Columbia, and Alaska to Mexico, Panama, Peru, and Chile; and a study of their physical and political conditions. By C. Reginald Enock. London: Grant Richards, 1909. Size 9 × 5½, pp. xii. and 356. *Map and Illustrations. Price* 16*s. net. Presented by the Author.*

Canada. **Laut.**

Canada: the Empire of the North. Being the romantic story of the New Dominion's growth from colony to kingdom. By Agnes C. Laut. Boston and London: Ginn & Co., 1909. Size 8½ × 5½, pp. xxvi. and 446. *Illustrations and Facsimile maps. Price* 7*s.* 6*d. net. Presented by the Publishers.*

Canada—British Columbia. **Walbran.**

British Columbia coast names, 1592–1906; to which are added a few names in adjacent United States territory. Their origin and history, by Captain John T. Walbran. Published . . . for the Geographic Board of Canada. Ottawa: Government Printing Bureau, 1909. Size 9 × 6, pp. 546. *Map and Illustrations. Presented by the Geographic Board of Canada.*

Canada—North-West. **Cameron.**

The New North; being some account of a woman's journey through Canada to the Arctic. By Agnes Deans Cameron. New York and London: D. Appleton & Co., 1910 [1909]. Size 9½ × 6, pp. xx. and 398. *Sketch-map and Illustrations. Presented by the Author.*

Canada—North-West. **Chambers.**

The Great Mackenzie Basin. Reports of the Select Committees of the Senate, Sessions 1887 and 1888. A summary of the Reports of the "Schultz Committees" of the Senate of Canada (1887–88), and of the evidence heard before said Committees bearing upon the natural resources of that portion of the Canadian North-West which still remains unexploited. Edited by Captain Ernest J. Chambers. Ottawa, 1908. Size 9½ × 6½, pp. 80. *Maps and Illustrations. Presented by Mr. R. E. Young, Railway Lands Branch.*

Canada—Resources. **Young.**

Evidence of Mr. R. E. Young . . . before the Select Standing Committee on Forests, Waterways, and Water-powers, 1909. Ottawa, 1909. Size 9½ × 6½, pp. 18. *Map.*

Canada—Saskatchewan. **Crean.**

Department of the Interior, Canada. Northland exploration. Report of exploration by Frank J. P. Crean in Saskatchewan, between the Saskatchewan and Churchill rivers, Season of 1908. Ottawa, 1909. Size 10 × 7, pp. 44. *Maps and Illustrations. Presented by Mr. R. E. Young.*

Canada—Yukon. ———

The Yukon territory: its history and resources. Issued by direction of the Minister of the Interior. Ottawa, 1909. Size 9½ × 6½, pp. iv. and 140. *Map and Illustrations. Presented by the High Commissioner for Canada.*

Labrador. **Grenfell.**

Labrador: the country and the people. By Wilfrid T. Grenfell and others. New York: The Macmillan Co., 1909. Size 7½ × 5½, pp. xii. and 498. *Map and Illustrations. Price 10s. net. Presented by the Publishers.*

Mexico. **Carson.**

Mexico: the wonderland of the South. By W. E. Carson. New York and London: Macmillan, 1909. Size 7½ × 5½, pp. xii. and 440. *Map and Illustrations. Price 10s. net. Presented by the Publishers.*

Mexico—Bibliography. ———

List of works in the New York Public Library relating to Mexico. New York, 1909. Size 10 × 7, pp. 186. *Presented by the New York Public Library.*

A valuable catalogue, though the aids to its use are not so complete as they might have been. Thus the headlines give no indication of the main sections into which it is divided, and there is no index of authors—a serious defect, inasmuch as the main arrangement is either by subjects or dates.

United States—Minnesota. **Robinson.**

The Wealth of Minnesota. By Edward Van Dyke Robinson. (Reprinted from *Proceedings* of the Minnesota Academy of Social Sciences, Minneapolis, December 3–4, 1908.) Minnesota, 1908. Size 9 × 6, pp. 98–118.

United States—Nebraska. **Stevens.**

U.S. Geol. Surv., Water Supply Paper No. 230 (1909): pp. 252.

Surface Water Supply of Nebraska. By J. C. Stevens. *Sketch-map, Illustrations, and Diagrams.*

United States—New Jersey. *J. Geology* 17 (1909): 351–379. **Kümmel.**

Geological Section of New Jersey. By Henry B. Kümmel.

United States—North Dakota. **Will and Spinden.**

Papers, Peabody Museum 3 (1906): 85–219.

The Mandans. A study of their Culture, Archæology, and Language. By G. F. Will and H. J. Spinden. *Maps, Plans, Sections, and Illustrations.*

United States—Oregon. **Waring.**

U.S. Geol. Surv., Water Supply Paper, No. 231 (1909): pp. 94.

Geology and Water Resources of the Harney Basin Region, Oregon. By Gerald A. Waring. *Maps and Illustrations.*

United States—Population. *Popular Sc. Monthly* 75 (1909): 209–220. **Brigham.**

Capacity of the United States for Population. By Prof. Albert Perry Brigham.

The writer takes a cautious view on this question, and arrives at a figure of about 305,000,000.

United States—Population. ———

Department of Commerce and Labor. Bureau of the Census. A Century of Population Growth from the First Census of the United States to the Twelfth, 1790–1900. Washington, 1909. Size 12 × 9½, pp. x. and 304. *Maps, Diagrams, and Illustrations.*

United States—South-West. **Mendenhall.**

U.S. Geol. Surv., Water Supply Paper, No. 234 (1909): pp. 98.

Some Desert Watering Places in South-Eastern California and South-Western Nevada. By Walter C. Mendenhall. *Map and Illustrations.*

United States—Waterways. **Quick.**

American inland waterways: their relation to railway transportation and to the national welfare; their creation, restoration, and maintenance. By Herbert Quick. London, etc.: G. P. Putnam's Sons, 1909. Size 9½ × 6½, pp. xx. and 242. *Maps and Illustrations. Price 25s. net. Presented by the Publishers.*

CENTRAL AND SOUTH AMERICA.

Andes. **Neveu-Lemaire.**

Dirección General de Estadística y Estudios Geográficos. Los lagos de los altiplanos de la América del Sud. Por el Dr. M. Neveu Lemaire. Traduccion española. La Paz, 1909. Size 10 × 7, pp. viii., 154, civ., xiv. *Maps, Sections and Illustrations. Presented by the Oficina Nacional de Estadística, Bolivia.*

The original work was reviewed in vol. 31, p. 325. This edition reprints in an appendix a number of earlier papers on Lake Titicaca.

Brasil. ———

"Centre Industriel du Brésil." Le Brésil: ses richesses naturelles, ses industries . . . Publié par le Service d'Expansion Economique du Brésil. Tome II. Paris: Aillaud & Cie., 1910. Size 11 × 7½, pp. 416. *Map and Illustrations. Presented by the Mission Brésilienne de Propagande, etc.*

Chile. **Bürger.**

Acht Lehr- und Wanderjahre in Chile. Von Prof. Dr. Otto Bürger. Leipzig: Dieterichsche Verlagsbuchhandlung, 1909. Size 9 × 6, pp. xii. and 610. *Illustrations. Price* 10*m. Presented by the Publishers.*

See Review, *ante*, p. 439.

Chile. **Poirier.**

Chile en 1908. Por Eduardo Poirier. Santiago de Chile, 1909. Size 10½ × 7, pp. x. and 288. *Maps and Illustrations. Presented by the Author.*

South America—Anthropology. **Boman.**

Mission scientifique G. de Créqui Montfort et E. Sénéchal de la Grange. Antiquités de la région andine, de la république argentine, et du désert d'Atacama. Par Eric Boman. Tome second. Paris: Imprimerie Nationale, 1908. Size 11 × 7½, pp. 389–950. *Map and Illustrations. Presented by M. G. de Créqui Montfort.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia—Historical. *J. and P.R.S. New South Wales* **43** (1909): 39–54. **Hargrave.**

Lope de Vega. By Lawrence Hargrave. *Illustrations.*

In these somewhat disjointed notes the author appears to suggest that Lope de Vega, Mendaña's companion in his last voyage, was wrecked on one of the Murray islands; but the basis for the theory seems quite inadequate.

Australia—Handbook. ———

The Handbook of Australia. A guide for intending immigrants. N.P., N.D. *Map.*

Australia—Rainfall. *J. and P.R.S. New South Wales* **42** (1908): 253–263. **Barling.**

The Rainfall of Australia. By John Barling. *Diagrams.*

German Pacific. *Deutsches Kolonialblatt* **18–20** (1907–09): *passim.* ———

Deutsch-Neuguinea. Die deutsche Marine-Expedition 1907–09.

German Pacific—Neu Pommern. *Globus* **96** (1909): 64–67. ———

Von der Hamburger Südsee-Expedition. Erste Durchquerung von Neu-Pommern. *Maps.*

See note in vol. **34**, p. 345.

POLAR REGIONS.

Antarctic. **Faustini.**

E. H. Shackleton e la questione antartica. Del Arnaldo Faustini. (Dalla *Nuova Antologia*, 1° Settembre 1909.) Rome, 1909. Size 9½ × 6, pp. 12. *Portrait and Sketch-map. Presented by the Author.*

Antarctic—Exploration. *P. American Phil. S.* **48** (1909): 34–50. **Balch.**

Why America should Re-explore Wilkes Land. By Edwin Swift Balch. *Chart.*

Antarctic—Geological History. *Naturw. Wochenschrift* **24** (1909): 449–454. **Kolbe.**

Die Südpolarkontinenttheorie nebst Bemerkungen über tiergeographische Verhältnisse auf der Südhemisphäre. Von Prof. H. Kolbe.

Antarctic—Magnetism. **[Chree and others.]**

National Antarctic Expedition, 1901–1904. Magnetic observations. Prepared under the Superintendence of the Royal Society. London: Royal Society, 1909. Size 12½ × 9, pp. viii. and 274. *Map, Illustration, and Diagrams. Presented by the Royal Society.*

Arctic—Ethnology. **Byhan.**

Die Polarvölker. Von Dr. A. Byhan. (Wissenschaft und Bildung . . . herausgegeben von Dr. Paul Herre, 63.). Leipzig: Quelle & Meyer, 1909. Size 7½ × 5, pp. 148. *Illustrations. Price* 1.25*m. Presented by the Publishers.*

Arctic—Exploration. *Deutsche Rundschau G.* **36** (1909): 243–264. **Baschin.**

Ziele und Erfolge der Nordpolarforschung. Von Otto Baschin.

MATHEMATICAL GEOGRAPHY.

Calendar. **Philip.**

A Proposal for a Simplified Calendar. By Alexander Philip. Third edition. London: William Ritchie & Sons; Edinburgh and London, 1908. Size 8½ × 5½, pp. 36. *Presented by the Author. Price* 6*d.*

Cartography. *Scottish G. Mag.* **25** (1909): 597-600. **Smith.**

New land maps of the world. By Stephen Smith. *Map.*

On modified projections for educational use.

Cartography. ———

Service Géographique de l'Armée. Rapport sur les travaux exécutes en 1908. Paris, 1909. Size 10 × 6½, pp. 46. *Index-maps.*

Cartography—Projections. *Sitz. K.A.W. München* (1909): Abh. 13, pp. 48. **Behrmann.**

Zur Kritik der flächentreuen Projektionen der ganzen Erde und einer Halbkugel. Von Dr. Walter Behrmann. *Maps and Diagrams. Also separate copy* (size 9 × 6).

Navigation. **Aquino.**

Altitude and azimuth tables for facilitating the determination of lines of position and geographical position at sea. The simplest and readiest in solution. Spherical traverse tables for solving all problems of navigation. By Lieut. Radler de Aquino London: J. D. Potter, 1910 [1909]. Size 10 × 6, pp. xl. and 128. *Price* 10*s.* 6*d. net. Presented by the Publisher.*

Surveying. **Middleton and others.**

A treatise on surveying. Compiled by Reginald E. Middleton, Osbert Chadwick, and J. du T. Bogle. Second edition. Two vols. London: E. & F. N. Spon, 1906 09. Size 10 × 6, pp. (vol. 1) xiv. and 286; (vol. 2) xvi. and 328. *Sketch-maps and Diagrams. Price* 10*s.* 6*d. net.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. **Hann.**

Handbuch der Klimatologie. Von Dr. Julius Hann. Dritte . . . Auflage. II. Bd.: Klimatographie; 1. Teil—Klima der Tropenzone. (Bibliothek geographischer Handbücher, begrundet von Friedrich Ratzel. Neue Folge; herausgegeben von Prof. Dr. Albrecht Penck.) Stuttgart: J. Engelhorn, 1910. Size 9 × 6, pp. xii. and 426. *Diagrams. Price* 14*m. Presented by the Publisher.*

Climatology. *Met. Z.* **26** (1909): 447–454. **Kerner.**

Die extremen thermischen Anomalien auf der Nordhemisphäre und ihre Bedeutung für die Frage der geologischen Polverschiebungen. Von Fritz v. Kerner.

Climatology—Desiccation. *Ts. K. Ned. Aardr. Genoots.* **26** (1909): 598–603. **Böeseken.**

Het uitdrogings-proces der aard-oppervlakte. Door M. J. H. Böeseken.

Coast-Erosion. **Stanton.**

Erosion of the coast and its prevention. By F. W. S. Stanton. London: St. Bride's Press, [1909]. Size 7½ × 5, pp. 68. *Sketch-maps and Sections. Price* 3*s. net. Presented by the Publishers.*

Coral Islands. *P. Zoological S.* (1909): 671–679. **Jones.**

The Coral Island Question. On a theory of Atoll Formation. By Dr. F. Wood Jones.

Earth's Axis. *Popular Sc. Monthly* **75** (1909): 417–434. **Townley.**

The Shifting of the Earth's Axis. By Dr. Sidney Dean Townley. *Diagrams and Illustrations.*

Geology. *P. American Phil. S.* **48** (1909): 119–125. **See.**

The Past History of the Earth as inferred from the Mode of Formation of the Solar System. By T. J. J. See.

Geomorphology. **Suess**

The Face of the Earth. (Das Antlitz der Erde.) By Eduard Suess. Translated by Hertha B. C Sollas, under the direction of W. J. Sollas. Vol. 4. Oxford: Clarendon Press, 1909. Size 9½ × 6½, pp. viii. and 674. *Maps, Sections, and Illustrations. Price* 25*s. net. Presented by the Publishers.*

This corresponds to vol. 3, part 2, of the German edition, lately issued.

Oceanography—Currents. *Ann. Hydrographie* **37** (1909): 271–277. ——

Einfluss des verschiedenen spezifischen Gewichts von Salz- und Süsswasser auf die Strömungen und die Ablagerung von festen Stoffen in Tideströmen. Von v. H. *Plan and Diagrams.*

Oceanography—Fishery. *B.I. Oceanog. Monaco*, No. 153 (1909): pp. 24. **Coquidé.**

La Pêche à la Morue. Par M. Coquidé.

Oceanography—Indian Ocean. *Ann. Hydrographie* **37** (1909): 351–356. **Schwendig.**

Beobachtungen der Temperatur und des Salzgehalts der Meeresoberfläche zwischen Suez und Sydney. Von E. Schwendig.

Oceanography—North Atlantic. *Nature* **81** (1909): 529–533. **Bauer and Peters.**

First Magnetic Results obtained on the *Carnegie* in the North Atlantic. By Dr. L. A. Bauer and W. J. Peters. *Illustration and Diagram.*

Oceanography—North Sea. **Thompson.**

Fourth report (northern area) on fishery and hydrographical investigations in the North Sea and adjacent waters. Conducted . . . under the superintendence of D'Arcy Wentworth Thompson. 1906–1908. Hydrography. London, 1909. Size 13 × 8½, pp. iv. and 196. *Chart, Sections, and Diagrams.*

See p. 433, *ante.*

Oceanography—South Pacific. **Nippe and Trotha.**

Ann. Hydrographie **37** (1909): 346–348.

Lotungen S.M.S. *Planet* bei Neu-Mecklenburg und den Salomo-Inseln. Von Kommdt.-Kapt. Nippe und Kommdt. v. Trotha.

Oceanography—Voyage. ——

Forschungsreise S.M.S. *Planet*, 1906–07. Herausgegeben vom Reichs-Marine-Amt. IV. Band, Biologie. Von Dr. Gräf. Berlin: K. Siegismund, 1909. Size 12 × 9, pp. vi. and 198. *Maps and Illustrations. Presented by the Imperial Foreign Office, Berlin.*

Physical Geography. **Martonne.**

Emmanuel de Martonne. Traité de géographie physique, climat, hydrographie, rélief du sol, biogéographie. Paris: A. Colin, 1909. Size 10 × 6½, pp. viii. and 912. *Maps and Illustrations. Price* 22 *fr. Presented by the Publisher.*

Seismology. *P. American Phil. S.* **48** (1909): 303–312. **Reid.**

Seismological Notes. By Harry Fielding Reid. *Diagrams.*

Seismology. *Deutsche Rundschau G.* **31** (1909): 529–538. **Krebs.**

Die Rätsel des 10. Juli 1907 in ihrem geophysikalischen Zusammenhange. Von Wilhelm Krebs. *Map.*

Refers to the disaster to the expedition of Prof. von Knebel (*Journal*, vol. 30, p. 436), which the writer connects with a world-shaking earthquake of July 10, 1907.

Terrestrial Magnetism. *Terrestrial Magnetism* **13** (1908): 97–104. **Bauer.**

The Earliest Values of the Magnetic Declination. By L. A. Bauer.

Volcanoes. *Geol. Mag.* V. **6** (1909): 432–434. **Johnston-Lavis.**

The Mechanism of Volcanic Action. . . . By H. J. Johnston-Lavis. *Diagram and Illustrations.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography—Islam. **Hell.**

Die Kultur der Araber. Von Dr. Joseph Hell. (Wissenschaft und Bildung . . . herausgegeben von Dr. Paul Herr, 64.) Leipzig: Quelle und Meyer, 1909. Size 7½ × 5, pp. 144. *Illustrations. Price* 1.25*m. Presented by the Publishers.*

Anthropogeography—Towns. *La G., B.S.G. Paris* **20** (1909): 164–176. **Clousot.**

Le problème de la formation des villes. Par Étienne Clousot.

Commercial. *Scottish G. Mag.* **25** (1909): 561–576. **Chisholm.**

A hundred years of commerce between England and America. By George G. Chisholm.

Commercial—Trade Routes. *Ann. Hydrographie* **31** (1909): 122–124. ——

Die deutschen Dampferwege vom Kap der Guten Hoffnung nach Adelaide und Melbourne und die neu vereinbarten englischen Schnittpunkte im südlichen Indischen Ozean. Von R. *Sketch-chart.*

By mutual agreement several English lines have agreed on the latitudes in which stated meridians are to be crossed. It is claimed that the respective German summer and winter routes possess advantages over the English route.

Economic—Forestry. *B.S. Languedoc. G.* **32** (1909): 5–24. **Sorre.**

Questions Forestières. Par M. Max Sorre.

Health. **Latham.**

Influence of the Soil and Ground-water upon Health. By Baldwin Latham. London: West, Newman & Co., 1909. Size 8½ × 5½, pp. 12. *Diagrams. Presented by the Author.*

Historical—Cosmas. **Winstedt.**

The Christian Topography of Cosmas Indicopleustes. Edited with geographical notes by E. O. Winstedt. Cambridge: University Press, 1909. Size 8½ × 5½, pp. x. and 376. [Greek text; Notes only in English.] *Facsimile Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

This carefully edited edition will appeal principally to scholars. As regards the geographical notes, the author acknowledges his indebtedness to Mr. McCrindle's English edition, issued by the Hakluyt Society.

Historical—Voyages. **Ward and Waller.**

The Cambridge History of English Literature. Edited by Dr. A. W. Ward and A. R. Waller. Vol. 4. Prose and poetry; Sir Thomas North to Michael Drayton. Cambridge: University Press, 1909. Size 9½ × 6½, pp. xii. and 582. *Price* 9*s. net. Presented by the Publishers.*

Chapters deal with Sir W. Raleigh, the literature of the sea, and with seafaring and travel, in the period under review.

BIOGRAPHY.

Banks. **Maiden.**

Sir Joseph Banks, the "Father of Australia." By J. H. Maiden. Sydney (London: K. Paul & Co.), 1909. Size 8½ × 5½, pp. xxiv. and 244. *Portraits, Maps, and Illustrations. Price* 6*s.*

Bureau. *B.S.G. Québec* **3** (1909): No. 5, 23–37. **Le Vasseur.**

Joseph Bureau, explorateur canadien. Par N. Le Vasseur. *Portrait.*

Duro. *B.R.S.G. Madrid* **51** (1909): 273–324. **Saralegui y Medina.**

El Excmo. Sr. D. Cesáreo Fernández Duro. [Papers by D. Manuel de Saralegui y Medina and others.] *Portrait.*

Señor Duro's literary output included various papers on the history of geography. (Cf. Obituary Notice in vol. 32, p. 192.)

Petermann. *G. Anzeiger* **10** (1909): 229–230. **Haack.**

Das Petermann-Denkmal in Gotha. Von Dr. Hermann Haack. *Illustration.*

GENERAL.

Almanack. **Olsen.**

The Fisherman's Nautical Almanack, Tide Tables, and a Directory of British and Foreign Fishing Vessels, Steamers, etc., 1910. By O. T. Olsen. London: Messrs. Imray, Laurie, Norie, & Wilson, Ltd Size 7½ × 5, pp. xliv. and 514. *Presented by the Author.*

Bibliography. **Raveneau.**

Annales de Géographie, No. 101, XVIII^e Année, 15 Septembre 1909. XVIII^e Bibliographie Géographique Annuelle, 1908. Publiée sous la direction de Louis Raveneau. Paris: Armand Colin. Size 10 × 6½, pp. 336.

British Empire. **Enock**

Your Share of Empire. A new Imperial Doctrine. The remedy for Overtaxation, Overcrowding, Unemployment, and Socialism. By C. Reginald Enock. Northwood. [1909.] Size 7 × 5, pp. 16. *Presented by the Author.*

Suggests that each community within the British Isles should acquire a share in the over-sea territory of the Empire.

Catalogue of Manuscripts. **Young and Aitken.**

A catalogue of the manuscripts in the Library of the Hunterian Museum in the University of Glasgow. Planned and begun by the late Dr. John Young; continued and completed . . . by P. Henderson Aitken. Glasgow: MacLehose & Sons, 1908. Size 11½ × 9, pp. xii. and 566. *Portrait. Presented by the University of Glasgow.*

The collection includes a few items of geographical interest.

Descriptive Sketches. **Laurence.**

Little folk in many lands. Arranged by Hugh Laurence. London, etc.: Blackie & Son, 1909. Size 8½ × 6½, pp. 128. *Illustrations. Price* 1*s. Presented by the Publishers.*

Education. **Lewis.**

Typical school journeys: a series of open-air geography and nature studies. By G. G. Lewis. With Foreword by the Rev. Canon Barnett. London: Sir I. Pitman & Sons, [1909]. Size 7½ × 5, pp. 140. *Illustrations. Price* 1*s.* 6*d. Presented by the Publishers.*

Education—Description. ———

The scholar's book of travel: Literary extracts from the best books of travel: Parts: 1, The British Isles, and readings in physical geography (pp. viii. and 198); 2, Europe (pp. viii. and 198); 3, Other lands (pp. viii. and 200); and 4, The British Empire (pp. viii. and 200). London: G. Philip & Son, [1909–1910]. Size 7½ × 5. *Maps and Illustrations. Price* 1*s.* 3*d. each. Presented by the Publishers.*

Education—Text-book. **Emerson.**

Manual of physical geography. By Dr. Frederick Valentine Emerson. New York: Macmillan Co., 1909. Size 8½ × 5½, pp. xviii. and 292. *Diagrams. Price* $1.40 *net. Presented by the Publishers.*

Education—Text-book. **Wood.**

Normal Tutorial Series. A physical and Economic geography of the World. By C. A. Wood. London: The Normal Press, [1909]. Size 7 × 4½, pp. iv. [710 and xl.]. *Sketch-maps and Diagrams. Price* 4*s.* 6*d. net. Presented by the Publishers.*

Fictitious Travel. *Travel and Exploration* 2 (1909): 327–332. **Keltie.**

Travellers' Tales. By Dr. J. Scott Keltie.

Geographical Pictures. **Grosvenor.**

Scenes from every land. Second Series. A collection of 250 illustrations, picturing the people, natural phenomena, and animal life in all parts of the world, with . . . a bibliography. Edited by Gilbert H. Grosvenor. Washington: National Geographic Society, 1909. Size 10 × 7, pp. 224. *Map and Illustrations. Price* $1. *Presented by the National Geographic Society.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 28, 1910.

4 miles to 1-inch.

Revised (second edition). In outline 19 and 23. *Price* 1*s.* 6*d.* (*engraved*).

2 miles to 1-inch.

Printed in colours and hills shown by the Layer System, folded in covers or flat in sheets. Special Map of Country around Aldershot. Pts. of sheets 28, 33, 34. 39. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*; *mounted in sections,* 2*s.* 6*d.*

1-inch—(third edition):—
In outline, 340. *Price* 1*s.* (*engraved*).
With hills in brown or black, 131, 340. *Price* 1*s. each* (*engraved*).
Large Sheet Series, printed in colours, folded in covers or flat in sheets, 46, 138, 139. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*; *mounted in sections,* 2*s.* 6*d.*

6-inch—County Maps:—
Hants, 8 sheets. Kent, 11 sheets. Yorkshire, 23 sheets. *Price* 1*s. each.*

25-inch—County Maps:—
Cheshire, 7 sheets. Hants, 52 sheets. Lancashire, 15 sheets. Sussex, 38 sheets. Yorkshire, 47 sheets. *Price* 3*s. each.*
(*E. Stanford, London Agent.*)

British Isles—England and Wales. **Geological Survey.**

Geological Survey of England and Wales, 4 miles to 1 inch: Barmouth, Chester, Holyhead, Shrewsbury, Sheets 9 and 10. Derby, Lincoln, Sheffield, Stafford, Sheet 11. *Price* 2*s.* 6*d. each:*
(*E. Stanford, London Agent.*)

British Isles—London. **Stanford.**

A new map of Metropolitan Railways, Tramways, and Miscellaneous Improvements, deposited at the London County Council, November 30, 1909, for Session 1910. Scale 1:63,360 or 1 inch to 1 stat. mile. London: Edward Stanford, 1910. *Price* 2*s.*

British Isles—Wales. **Railway Clearing House.**

Official Railway Map of South Wales. Scale 1:63,360 or 1 inch to 1 stat. mile. 2 sheets. London: Railway Clearing House, 1910. *Price* 11*s.*

Europe. **Survey Department, Cairo.**

School Map of Western Europe. [In Arabic.] Scale 1:1,000,000 or 1 inch to 15·7 stat. miles. 4 sheets. Cairo: Survey Department, 1909. *Presented by the Director-General, Survey Department, Cairo*

A general political map intended for the use of Egyptian schools, showing also principal railways canals, steamship routes, and telegraph cables. Like others of the series, the lettering is in Arabic.

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Sheets: xi.–36, Oloron; xii.–29, Castillon; xvii.–11, Compiègne; xvii.-24, Evaux; xix.–28, Langeac; xxi.–10, Rethel; xxiii.–27, Voiron. Paris: Hachette & Cie, 1909. *Price* 0·80 *fr. each sheet.*

These are new editions.

France. **Service Géographique de l'Armée, Paris.**

Carte de France. Scale 1: 50,000 or 1·3 inch to 1 stat. mile. Sheets: xxv.–50, Cerbère; xxxiii.–46, Toulon. Paris: Service Géographique de l'Armée, 1909. *Price* 1.60 *fr. each sheet.*

Holland. **Topographical Bureau, The Hague.**

Chromo-topographische Kaart van het Koninkrijk der Nederlanden. Scale 1:50,000 or 1·3 inch to 1 stat. mile. Sheets: 10, Sneek; 11, Heerenveen; 15, Stavoren; 16, Steenwijk. The Hague: Topographical Bureau, [1910].

Hungary. **Rezsö.**

Staatsrechtliche Karte des Ungarischen Reiches. Von Dr. Havass Rezsö. Scale 1:1,000,000 or 1 inch to 15·7 stat. miles. With Text. Budapest: Hungarian Geographical Institute, Ltd., 1909. *Presented by the Publishers.*

A somewhat roughly drawn outline-map without hill-shading, showing the recently annexed provinces of Bosnia and Herzegovina as forming part of the kingdom of Hungary. The accompanying explanatory pamphlet makes it clear that the map has been published with the special object of showing these provinces as forming part of Hungary, and not a separate third division of the Austro-Hungarian Empire as they are indicated on the Triaskarte von H. Hanau, which was mentioned in the November number of the *Geographical Journal*, and with which the author of the present map does not agree.

Hungary. **Zsigmond.**

Ethnographical map of Hungary. By Dr. Bátky Zsigmond. [In Hungarian.] Scale 1:600,000 or 1 inch to 9·5 stat. miles. 4 sheets. Budapest: Hungarian Geographical Institute, Ltd., 1909. *Presented by the Publishers.*

The general basis of this wall map is the census of 1900. It shows the various

nationalities inhabiting Hungary by twelve different colours and symbols, the predominating Magyar people being indicated by bright red. All nationalities forming less than 10 per cent. of the population of any area are omitted, exclusive of the cities. Uninhabited districts of high mountains or sandy steppes are left uncoloured. In those communities where the gipsies constitute 10 per cent. of the population, they are represented by black squares, and the basis of their enumeration is the census of 1893

Norway. **Norges Geografiske Opmaaling.**

Topografisk Kart over Kongeriget Norge. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 38 A. Övre Rendalen; M13. Sulitelma. Christiania: Norges Geografiske Opmaaling, 1909. *Presented by the Norwegian Geographical Institute.*

Norway—Christiania. **Norges Geografiske Opmaaling**

Kristiania Omegn. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Sheet iii. Christiania: Norges Geografiske Opmaaling, 1909. *Presented by the Norwegian Geographical Institute.*

ASIA.

Asia. **Survey Department, Cairo.**

Physical school map of Asia. [In Arabic.] Scale 1 : 6,000,000 or 1 inch to 94·7 stat. miles. 4 sheets. Cairo: Survey Department, 1909. *Presented by the Director-General, Survey Department, Cairo.*

Another of the series of maps, with Arabic lettering, specially constructed for use in Egyptian schools. It includes the whole of Asia and the greater part of Europe, and shows heights by tints of brown over hill shading and depths of water in different tints of blue. It is boldly executed for hanging on school walls.

Asiatic Russia. **Stanford.**

Stanford's map of the Siberian railway, the Great Land Route to China and Korea. Scale 1 : 6,800,000 or 1 inch to 107·3 stat. miles. London: Edward Stanford, 1910. *Price* 10*s.* 6*d.*

AFRICA.

Africa. **Geographical Section, General Staff.**

Africa. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet 72-Q and part of 72-W., Tarkwa, Gold Coast. London: Geographical Section, General Staff, War Office. E. Stanford, 1909. *Price* 2*s. each sheet. Presented by the Director of Military Operations.*

Africa. **Geographical Section, General Staff.**

Africa. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Sheets: Southern Rhodesia. 116-II., Urungwe; 116-III., Victoria falls; 116-IV., Gwelo; 117-I., Salisbury; 117-III., Umtali; 121-II., Bulawayo; 122-I., Victoria. London: Geographical Section, General Staff. Edward Stanford, 1909. *Price* 2*s. net each sheet. Presented by the Director of Military Operations.*

These sheets have been reduced from a map compiled in the office of the Surveyor-General of Southern Rhodesia, and are arranged and numbered to form part of the important map of Africa now under preparation at the Geographical Section of the War Office. Together they constitute by far the best general map of Southern Rhodesia that has yet been published, and supply a want long felt by all interested in the country. District boundaries, farms with their boundaries and names, native reserves, railways, roads, telegraphs, mission stations, mining claims, and much other information is given. Still much remains to be done, and there are many blanks to be filled in. There is no hill shading, but occasional heights are shown in figures.

Africa. **Sleeping Sickness Bureau**

Skeleton maps of Tropical Africa showing the distribution of Tsetse Flies and Sleeping Sickness. Scale 1 : 7,500,000 or 1 inch to 118·4 stat. miles. London: Sleeping Sickness Bureau, Royal Society, 1909. *Presented by the Director, Sleeping Sickness Bureau.*

East Africa. **Schlobach and Moisel.**

Karte der deutsch-portugiesischen Grenze zwischen dem oberen Rowuma und dem Njassa (Deutsch-Ostafrika) nebst Dreiecksnetz u. Höhenprofil. Nach den Originalzeichnungen des Majors Schlobach bearbeitet von M. Moisel. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. *Mitteilungen aus den deutschen Schutzgebieten*, Band xxiii. 1910, Map 2. Berlin: E. S. Mittler & Sohn, 1910. *Presented by Dietrich Reimer (Ernst Vohsen), Berlin.*

This short section of the boundary between German and Portuguese East Africa

extends for about 40 miles east of Lake Nyasa to the Rovuma river, approximately along the parallel of lat. 11° 34′ S. It has now been surveyed, and the results are shown on the above map. The boundary further east follows the Rovuma river. Below the map is a vertical section of the line.

Egypt. **Survey Department, Cairo.**

Topographical map of Egypt. Scale 1: 10,000 or 6·3 inches to 1 stat. mile. Sheets: N.E. 1–6, 7–2, 9–11, 11–8, 11–9; S.E. 16–3, 16–4, 17–3. Cairo: Survey Department, 1909. *Presented by the Director-General, Survey Department, Cairo.*

Egypt. **Survey Department, Cairo.**

Topographical survey of the Nile. Scale 1: 25,000 or 2·5 inches to 1 stat. mile. Sheets 1 to 9, Sarras—Abu Fatma. Cairo: Survey Department, 1909. *Presented by the Director-General, Survey Department, Cairo.*

Reduced from original tacheometric surveys on the scale of 1: 10,000 made in 1905–7. Contour-lines determined by levelling are shown by brown firm lines, and approximate outlines of hills by broken form lines. The sheets show the Nile and its banks only.

Egypt. **Survey Department, Cairo**

Map of Egypt. Scale 1: 50,000 or 1·3 inch to 1 stat. mile. Sheets: S.E. XXXIV.–VIII. Gerf Husein; XXXV.–VII. El Dakka; XXXIX.–IV. Farriq. Cairo: Survey Department, 1909. *Presented by the Director-General, Survey Department, Cairo.*

Egypt. **Survey Department, Cairo.**

Map of Egypt. Scale 1: 1,000,000 or 1 inch to 15·7 stat. miles. 6 sheets. Cairo: Survey Department, 1909. *Presented by the Director-General, Survey Department, Cairo.*

This map includes the area between 20° and 32° N. lat., and thus shows the Nile from below Wadi Halfa to its delta. On the east it extends to the Red sea and the Sinai peninsula, and to the west to beyond the Farafra oasis. It is a good general map of Egypt, and as such should be very useful. Hills are shown in brown horizontal form-lines, with heights in figures, water blue, and cultivable land green.

German East Africa. **Sprigade.**

Karte von Deutsch-Ostafrika. Neubearbeitung von P. Sprigade. Scale 1: 300,000 or 1 inch to 4·7 stat. miles. Sheets: G 5 u. H. 5, Mittlerer Rowuma. Berlin: Dietrich Reimer (Ernst Vohsen), 1909. *Presented by the Publisher.*

A new edition of a sheet published seven years ago. A comparison of the two will show that a considerable amount of new route-survey work has been done in the area during the interval, although there are still parts that are entirely unmapped.

German South-West Africa. **Sprigade and Moisel.**

Karte von Deutsch-Südwestafrika. Bearbeitet von Paul Sprigade und Max Moisel. Mit Namenverzeichnis. Scale 1: 2,000,000 or 1 inch to 31·5 stat. miles. Berlin: Dietrich Reimer (Ernst Vohsen), 1910. *Price 5m. Presented by the Publisher.*

A general coloured map of German South-West Africa, showing railways and roads open and projected, steamer and telegraph lines, district and other boundaries, post, telegraph, and customs stations, locations of mining companies, and other information. An index to place-names forms a useful supplement.

Morocco. **Service Geographique de l'Armée, Paris.**

Carte du Maroc. Scale 1: 100,000 or 1 inch to 1·6 stat. mile. Sheet 4, Settat. Paris: Service Géographique de l'Armée, [1910]. *Price 1fr. each sheet.*

Togo. **Sprigade and Thomas.**

Die Landschaften um den Agu. Hauptsächlich nach den Aufnahmen der Landkommission, 1904–08 (Regierungsrat Dr. Gruner), unter Leitung von P. Sprigade bearbeitet und gezeichnet von G. Thomas. Scale 1: 50,000 or 1·3 inch to 1 stat. mile. *Mitteilungen aus den deutschen Schutzgebieten*, Band xxiii. 1910, Map 1. Berlin: E. S. Mittler & Sohn, 1910. *Presented by Herr Dietrich Reimer, Berlin.*

AMERICA.

Chile. **Oficina de Mensura de Tierras, Santiago.**

Republica de Chile. Scale 1: 500,000 or 1 inch to 7·8 stat. miles. Sheets: Antofagasta, Concepcion, Lebu, Valparaiso. Santiago: Oficina de Mensura de Tierras, 1909. *Presented by the Oficina de Mensura de Tierras, Santiago.*

CHARTS.

Admiralty Charts. — **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during January, 1910. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 1691, South Atlantic ocean: Island of Ascension. Plans: English bay. North-east bay. South-west bay. Clarence bay, 3s. 1587, Japan: Yawatahama ko and approaches, 2s. 1674, Australia, east coast, Queensland: Brisbane river, 4s.—**New Plans and Plans added**—No. 1378, Tierra del Fuego, south-eastern part. Plan added: Herschel island anchorage, 3s. 685, Africa, east coast: Bazaruto bay. New plan: Limpopo river entrance, 2s. 1622, Ports in the Philippine islands. Plan added: Port Borongan. New plan: Port Libas, 3s.

Atlantic, North. — **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, March, 1910. London: Meteorological Office, 1910. *Price 6d. each. Presented by the Meteorological Office.*

Atlantic, North. — **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, February, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. — **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, April, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the Director, U.S. Weather Bureau.*

British Isles—Liverpool Bay. — **Mersey Docks and Harbour Board.**

Chart of Liverpool bay. Surveyed by the Marine Surveyor of the Mersey Docks and Harbour Board. Scale 1 : 3600 or 1·76 inch to 1 stat. mile. Liverpool: Mersey Docks and Harbour Board, 1909. *Presented by the Mersey Docks and Harbour Board.*

Indian Ocean and Red Sea. — **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, March, 1910. London: Meteorological Office, 1910. *Price 6d. each. Presented by the Meteorological Office.*

Norway. — **Norges Geografiske Opmaaling.**

Kystkarter. Generalkarter, scale 1 : 200,000 or 1 inch to 3·2 stat. miles, B8. Fleina og Sandhornet til Tranö; B9, Tranö til Gisund. Specialkarter, scale 1 : 50,000 or 1·3 inch to 1 stat. mile, Bilag til 38, Bunden av Hevnefjord; B41, Gjesingen til Halten; B64, Væröy til Lofotodden; B65, Lofotodden til Ure. Specialkart over Havne i Finmarken. Christiania: Norges Geografiske Opmaaling, 1910. *Presented by the Norwegian Geographical Institute.*

Pacific, North. — **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, March, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Pacific, North. — **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, April, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the Director, U.S. Weather Bureau.*

Pacific, South. — **U.S. Hydrographic Office.**

Pilot chart of the South Pacific Ocean, March, April, and May, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Bolivia and Peru. — **Adams.**

Twelve photographs of Bolivia and Peru, taken by Franklin Adams, Esq. *Presented by Franklin Adams, Esq.*

An excellent set of enlargements, measuring 12 × 9 inches, illustrative of town and country life. The ploughing and threshing scenes, and views of the llamas and alpacas are specially interesting.

(1) La Paz; (2) Market women in La Paz; (3) The return of the messenger,

La Paz; (4) Llamas on street of La Paz; (5) Ready for the harvest dance, Tiahuanaco; (6) House of the Four Almagros, Cuzco; (7) Types of the highlands; (8) Ploughing in the highlands; (9) Threshing in a highland valley; (10) Alpacas on the Puna; (11) The Llama driver, Oroya; (12) As in the days of Atahualpa.

Nyasaland. **Ritchie.**

Thirty-six photographs of the Nyasaland Protectorate, taken by Captain C. MacI. Ritchie, R.H.A., 1909. *Presented by Captain C. MacI. Ritchie, R.H.A.*

As may be judged from the titles, the subjects vary considerably, and perhaps some of the photographs will be more interesting to sportsmen than geographers. The heads of game are specially good, and views of scenery characteristic.

(1) Mrs. Livingstone's grave at Shupanga; (2) Natives poling a houseboat up the Shiré river; (3) Native goats; (4) Woman and child, South Nyasa; (5) Native cattle, Central Angoniland; (6) Pirolongwé mount; (7) Natives playing "Bauco"; (8) Stern-wheeler on the upper Shiré; (9) M'nguti ("German sausage") tree; (10) Near Fort Rifu; (11 and 12) Central Angoniland scenery; (13) Residency, Dedza; (14) View from Residency garden, Dedza; (15) Dedza mountain; (16) Camp on Tuchila plains; (17) Swahili, "capitao" from Zanzibar; (18) Difficulties of navigation on Shiré and Zambesi rivers in dry season; (19) Nyasaland natives *en route* for the Rand mines; (20) Chinde; (21) The *Boulogne*, formerly a Channel steamer, now "tramping" the east coast of Africa; (22) Warthog burrow; (23) Young warthogs; (24) Reedbuck; (25) Impala; (26 and 27) Buffalo: (28) Eland; (29) Bushbuck; (30) Kudu; (31 and 32) Elephants; (33) Villagers removing elephant meat; (34 and 35) Rhino; (36) Waterbuck.

South America. **Fawcett.**

Sixty-three photographs of South America, taken by Major P. H. Fawcett, R.A., 1909. *Presented by Major P. H. Fawcett, R.A.*

These photographs were taken during the expedition for surveying the boundary between Bolivia and Brazil, of which an account was given to the Society last month by Major Fawcett. They are all interesting, but those taken on the journey to the source of the Rio Verde are specially so, as the ground covered was entirely new, and owing to exceptional difficulties is not likely to be traversed again for a long time.

(1–5) Rosario, Rio Paraguay; (6 and 7) Corrientes, Rio Paraguay; (8) Asuncion; (9 and 10) The Rio Paraguay; (11) Post on Rio Paraguay; (12) Loading wood, Rio Paraguay; (13) Firewood, Rio Paraguay; (14) Coimbra; (15–18) Corumba; (19) Camp near Corumba; (20) Rio Paraguay at Corumba; (21) Rio Paraguay from Corumba; (22) Rio Paraguay, near Corumba; (23) Orlando, near Corumba; (24 and 25) Forest near Corumba; (26) Lake Caceres; (27 and 28) Camp on Lake Caceres; (29) Port Suarez, Lake Caceres; (30) Old city, Matto Grosso; (31) Street in old Matto Grosso; (32) Old cathedral, Matto Grosso; (33–37) Bolivian Boundary Commission, (38) Source of the Rio Verde; (39) Country round source of the Rio Verde; (40) Sandstone cañon in Rio Verde; (41–44) Near source of Rio Verde; (45) Boundary mark near source of Rio Verde; (46–51) The Rio Verde; (52) On the Rio Verde; (53) After the Rio Verde; (54–58) The Ricardo Franco rangos; (59) On the Ricardo Franco ranges; (60 and 61) Firewood and Chamacoco Indians; (62 and 63) Chamacoco Indians.

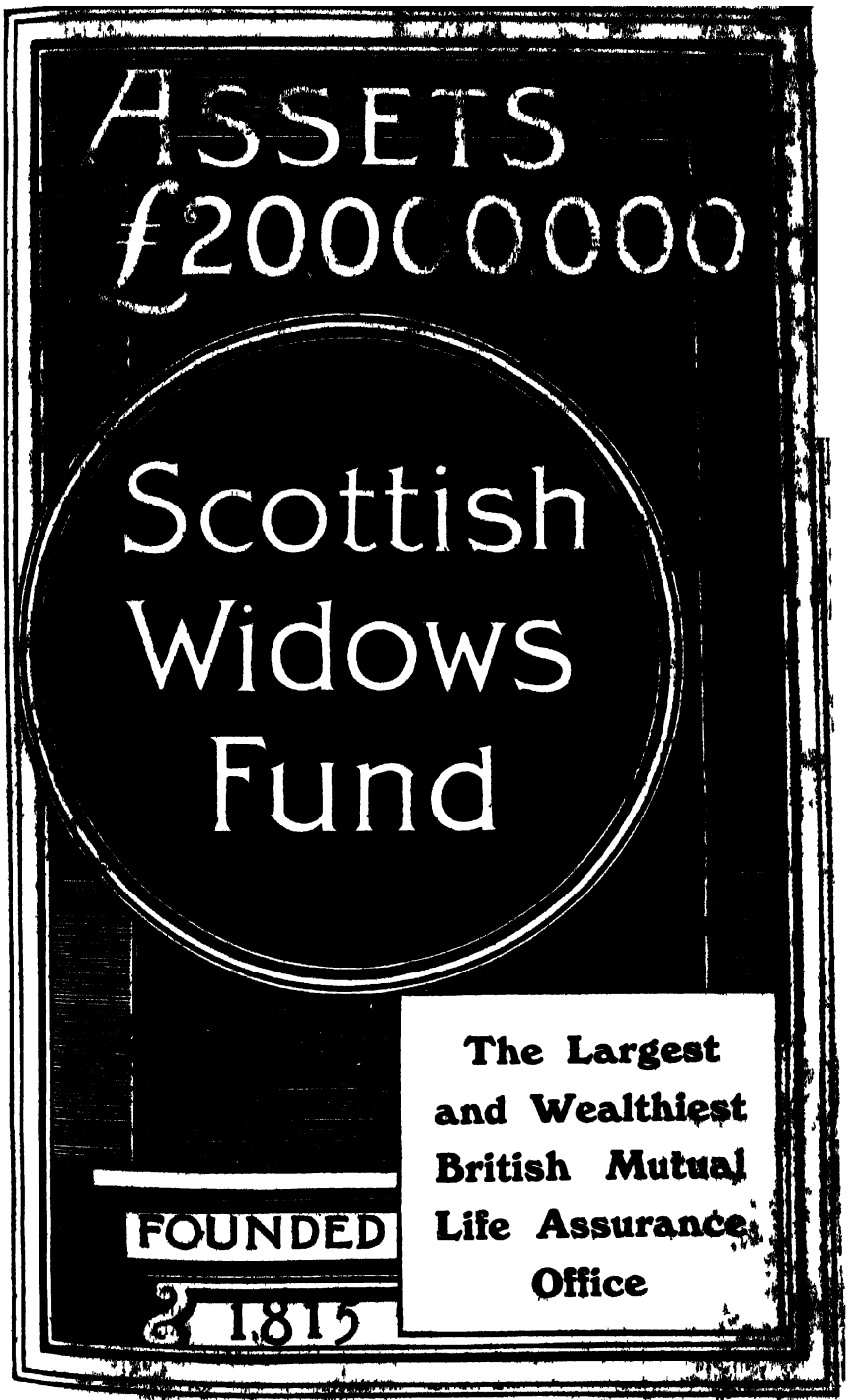
Venezuela. **Tregelles.**

Four Photographs of Natives of the Orinoco river, Venezuela, taken by J. A. Tregelles, Esq. *Presented by J. A. Tregelles, Esq.*

These photographs measure 5½ × 7½ inches, and are well taken.

(1 and 2) Types of natives on the Orinoco river; (3) Indian family, Orinoco river; (4) Boys with baskets.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


ASSETS
£20000000
Scottish
Widows
Fund
The Largest
and Wealthiest
British Mutual
Life Assurance
Office
FOUNDED
1815
HEAD OFFICE: 9 ST. ANDREW SQUARE, EDINBURGH.

MUTUAL
Life Assurance Society

ESTABLISHED 1815

THE SCOTTISH WIDOWS' FUND transacts all classes of Assurance and Annuity Business on the most favourable terms. Those desiring to effect Life Assurances with the greatest advantage to themselves should read the Society's Prospectus.

"Whole Life Insurance," payable at death. Owing to the large and steady Bonus declared, the results are favourable. A recent claim shows—

Original Sum Assured	£5,000	0	0
Bonuses	10,985	8	8
Total Sum Assured	£15,985	8	8

"Endowment Assurance," payable at a certain age or at previous death. Bonuses are at the same rate as on a Whole Life Policy. On survivance the Life Assured can utilise the money in various ways—he can receive the Cash, or purchase an Annuity or an Assurance payable at death, or take part in Cash and part as an Annuity or Assurance.

"Combined Income and Family Provision."

Under this scheme, on survivance to a specified age a fixed Cash payment is obtained, or alternatively an Annuity secured for 20 years certain and to the end of life if longer, while if death takes place before the age is reached the fixed sum or an Annuity for 20 years becomes payable.

"Pensions," "Temporary Assurances," "Immediate Annuities," "Double Endowments," etc.

For Children—"Deferred Assurances," "Pure Endowments," "Educational Annuities," etc.

Prospectuses, containing full particulars of the Society, may be had on application. Also Special Prospectus for Ladies.

HEAD OFFICE: EDINBURGH, 9 ST. ANDREW SQUARE.

LONDON: 28 CORNHILL, E.C., & 5 WATERLOO PLACE, S.W.

Dublin	41 Westmoreland St	Birmingham	12 Bennett's Hill
Glasgow	114 W. George Street	Leeds	21 Park Row
Liverpool	48 Castle Street.	Belfast	2 High Street
Manchester	21 Albert Square.	Bristol	28 Baldwin Street
Newcastle-on-Tyne	12 Grey Street.		

Printed by R. & R. Clark, Limited, Edinburgh.

HOTEL METROPOLE,

Northumberland Avenue, Trafalgar Square,

LONDON.



Of world-wide reputation. Conveniently situated, close to Houses of Parliament, Westminster Abbey, Government Offices, Theatres, fashionable quarters, and chief places of interest. Numerous luxuriously furnished suites of apartments. Most magnificent hotel lounge in London.

Telegrams: "*Mitropole, London.*"
Telephone: 8130 *Gerrard* (20 *lines*).

Gordon Hotels, Ltd.



SKINNER & GRANT,

TAILORS,

59, REGENT STREET, LONDON, W.

(*7 Doors from Piccadilly Circus*).

BEST GOODS AT MODERATE PRICES.

Frock Coat and Vest...	...	...	...	from	£4	4	0
Morning Coat and Vest	...	...	...	,,	3	10	0
Lounge Suits	...	...	...	...	...	,,	3	10	0
Trousers	...	...	...	...	...	...	,,	1	1	0
Overcoats	...	...	...	...	...	...	,,	3	3	0
Dress Suits	...	...	...	...	...	...	,,	5	5	0

MOTOR COATS A SPECIAL FEATURE A TRIAL ORDER SOLICITED.

BÂLE. "HOTEL, VICTORIA."

(*Quite near Central Railway Station.*)

First-class Family House of old reputation. Lately quite renewed. Fine Large Hall, New Salon, and Conversation Rooms. Restaurant. Electric light and central heating in whole house.

NEW BATHS. LIFT. GOOD CUISINE. MODERATE CHARGES.

Managed by the Proprietor—Paul Otto.

KEATING'S POWDER KILLS

Tins 1d. 3d. 6d. 1/-



BEETLES

THE WROUGHT IRON

CAMP OR TRAVELLING STOVE



To burn wood or any fuel.

Specially designed for Explorers, Missionaries, etc.

Made of malleable wrought iron. Cannot be injured by rough usage. Weight 36 lbs.

Price complete, £3.

Specialities in Oil Cooking Stoves for Home and Export. Any kind of stove made to order.

Send for a 100-page Illustrated Catalogue of Stoves for all purposes, which will be sent free by mail on application.

W. POORE & CO. American Stove Stores.

YOU CAN INSURE YOUR

Art Treasures, Family Heirlooms, &

AGAINST FIRE, BUT

Can You Replace Them?

THOUGH

"Dreadnought" Fireproof Doo

cost no more than Wood Doors and are of ordinary appearance, thickness, and weight, they have been able to withstand a temperature of 2000 degrees for 2½ hours. No hinged door of such a size has withstood

HALF AS GREAT AN OFFICIAL FIRE TEST AS T

Supplied to the Government for

The Admiralty, National Gallery, Victoria and Albert Museums, Imperial College of Science, Imperial I
Also Birmingham Telegraph Office; to Edinburgh Law Courts, Royal Insurance Company, Coutts's Bank, &c., &
to Lord Lilford, and many private mansions.

Write for full particulars to

"G.J." DEPT., FIREPROOF DOORS, Ltd.,
46, KING WILLIAM STREET, LONDON, E

BY ROYAL WARRANT TO H.M. THE KING.

POLISHED FLOORS.

RONUK, LTD

are prepared to Estimate for the Polishing and the maintenance of all kinds of floors in

MANSIONS, HOSPITALS, & INSTITUTIONS

WRITE FOR PAMPHLET

Manufacturers of "RONUK" SANITARY POLIS

"RONUK," LTD., Head Office & Factory, PORTSLADE, near BRIGH
Depôts—LONDON: 86, York Road, Lambeth, S.E.
MANCHESTER: 285, Deansgate.

The Geographical Journal.

Authors are alone responsible for their respective statements. In MS. communications all new or unfamiliar geographical names should be written in imitation of Roman type. All communications for the Editor should be addressed to 1, Savile Row, London, W.

CONTENTS—MAY.

PAGE

The Travels of a Botanist in South-West Africa. By H. H. W. Pearson, M.A., Sc.D., F.L.S., Professor of Botany in the South African College, Cape Town (with 5 Plates and Map) . 481
Explorations in Bolivia. By Major P. H. Fawcett, R.A. (retired) (with 6 Plates and Sketch-map) 513
Progress of Survey in the Anglo-Egyptian Sudan. By Captain Hugh D. Pearson, R.E., Director of Sudan Surveys (with Sketch-map) 532
The Danish North-East Greenland Expedition, 1906–8: Provisional Results. By Dr. J. Lindhard (with Sketch-map) 541
The Opening of the Oceanographical Museum at Monaco (with Illustration) 558
The Royal Commission on Canals and Waterways 565
Some Recent Changes in the Course of the Trent. By Bernard Smith, M.A., F.G.S. (with 5 Diagrams) 568
Musil's Explorations in Northern Arabia, 1908–9 (with Sketch-map) 579
Reviews:—
EUROPE—France. ASIA—Asia Minor. Ceylon. Northern China. East and Central Sumatra. AFRICA—Exploration and Sport in Eastern Equatorial Africa. AMERICA—The Chile-Argentine Frontier. Southern Chile. GENERAL—A Bibliography of Ptolemy's Geography 582
The Monthly Record 591

THE SOCIETY
The Society's Awards for 1910
EUROPE
Sheep and their Products in France
Mountain and Valley Winds on Lake Garda
ASIA
French Exploration in Cambodia and Annam
Geological Research in Baluchistan
The Pelliot Expedition in Central Asia
Nain Singh's Work in Tibet
American Expedition in North-West China
M Bacot on the China-Tibetan Frontier
AFRICA
Origin of the Nile Valley and Gulf of Suez
The Aboinia River, Southern Nigeria (with Sketch-map)
AMERICA
Explorations in the Home of the Wood Bison
The Boundary between Peru and Bolivia
The Madeira and Mamore Railway
AMERICA—*continued.*
The Natural Regions of the Argentine Republic
AUSTRALASIA AND PACIFIC ISLANDS
The Lost River Wairarapa, New Zealand
POLAR REGIONS
Dr. Charcot's Antarctic Expedition
Scottish Antarctic Expedition
The Proposed German Antarctic Expedition
MATHEMATICAL AND PHYSICAL GEOGRAPHY
The Voyage of the "Michael Sars"
Ground-water or Subterranean Rivers in the Karst
GENERAL
Oxford School of Geography
The Eleventh International Geological Congress
The Seventeenth Congress of Americanists
The Geographical Society of Neuchatel

Obituary—Alexander Agassiz. By Sir John Murray 602
Correspondence.—Desert Sand-dunes. By Captain David Comyn 605
Meetings of the Royal Geographical Society, Session 1909–1910 605
Geographical Literature of the Month 606
New Maps 614

MAPS.

Anglo-Egyptian Sudan positions geographically fixed by the Sudan Survey Department 535
Sketch-map showing the Surveys of the North-East Greenland Expedition, 1906–8 . 545
Sketch-map showing Explorations in Northern Arabia 580
Map of South-West Africa 620
Maps to illustrate a paper on Explorations and Boundary Surveys in Bolivia . . 620
Sketch-map of the Aboinia River 61

SOLD BY

PARIS: Barrère.
VIENNA: Artaria & Co.
HAMBURG: L. Friederichsen & Co.
ST. PETERSBURG: Watkins & Co.
MANCHESTER: John Heywood.
EDINBURGH: Douglas & Foulis.
DUBLIN: Hodges, Foster & Co.
BERLIN: D. Reimer.
LEIPZIG: F. A. Brockhaus.
NEW YORK: International News Co.

ROYAL GEOGRAPHICAL SOCIETY.

PATRON.

HIS MAJESTY THE KING.

VICE-PATRON.

HIS ROYAL HIGHNESS THE PRINCE OF WALES, K.G.

COUNCIL.

(ELECTED MAY 24, 1909.)

President—Major Leonard Darwin.

Vice-Presidents.

Admiral Sir Lewis Beaumont, K.C.B., K.C.M.G.
Rt. Hon. Lord Curzon of Kedleston, G.C.S.I., G.C.I.E., etc.
Douglas W. Freshfield.
Rt. Hon. Sir J. West Ridgeway, G.C.B., G K.C.S.I., LL.D.
H. Yates Thompson, J.P.
Sir Clements R. Markham, K.C.B., F.R.S

Treasurer—Edward L. Somers Cocks.

Trustees—Right Hon. Lord Avebury, D.C.L., F.R.S.; Lord Belhaven and Stento

Honorary Secretaries—Colonel Chas. F. Close, C.M.G., R.E.; Colonel Sir D. A. J K.C.M.G., C.B., R.E.

Foreign Secretary—Sir John Kirk, K.C.B., G.C.M.G., F.R.S.

Members of Council.

Henry Balfour, M.A., F.Z.S.
Captain H. H. P. Deasy.
Admiral A. Mostyn Field, F.R.S.
Colonel H. W. Feilden, C.B.
Sir William Edmund Garstin, G.C.M.G.
Sir David Gill, K.C.B., LL.D., F.R.S.
Rt. Hon. Sir George D. Taubman Goldie, K.C.M.G., F.R.S., D.C.L., LL.D.
Colonel R. C. Helland, C.B., R.E.
Sir Clement L. Hill, K.C.M.G., K.C.B., M.P.
Colonel Sir Thomas Hungerford Holdich, K.C.M.G., K.C.I.E., C.B., R.E.
James F. Hughes.
Rt. Hon. Lord Lamington, G.C.M.G.
Sir George S. Mackenzie, K.C.M.G., C.B
Halford John Mackinder, M.A.
Alfred P. Maudslay.
Colonel F. R. Maunsell, C.M.G., R.A.
Earl of Ronaldshay, M.P.
Captain R. F. Scott, C.V.O., R.N.
Colonel Sir Colin C. Scott-Moncrieff, K.C.S.I., R.E.
Dr. Aubrey Strahan, F.R.S.
Sir Edward P. Tennant, Bart., M.P.

Secretary and Editor of Publications—J. Scott Keltie, LL.D.
Librarian—Edward Heawood, M.A.

Map Curator.	Chief Clerk.
Edward A. Reeves, F.R.A.S.	S. J. Evis.

Bankers—Messrs. Cocks, Biddulph and Co., 43, Charing Cross.

Candidates for admission into the Society must be proposed and seconded by I and it is necessary that the description and residence of such Candidates should be stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and £3 a "subscription for the current year, and thereafter a yearly subscription of £3, due on the 1st "of each year; or he may compound either at entrance by one payment of £45, or at any su "period on the following scale, provided that there shall be at the time no arrears due b "the Society:—

Fellows of	10	years' standing	and under	15	...	£30
"	15	"	"	20	...	£24
"	20	"	and over		...	£18 15s.

"No fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrea

All Subscriptions are payable in advance, on the 1st of January in each yea

The privileges of a Fellow include admission (with one Friend) to all o Meetings of the Society, and the use of the Library and Map-room. Each Fellow entitled to receive a copy of all the Society's Periodical Publications.

Copies of the Year Book, Regulations, and Candidates' Certificates may be application at the Society's Office, 1, Savile Row, London, W.

Ideal
Fountain Pen

The World's best Fountain Pen, and the one you will eventually buy



Mr. Sydney Whitman writes: "Although I have received at different times various kinds of Fountain Pens as presents, I have nevertheless been obliged to invest in a Waterman's Ideal, and now use it exclusively."

Mr. Bennett Burleigh, the famous War Correspondent, writes: "It is the only Fountain Pen that does not dry up or blubber in the desert."

PRICES—10/6, 15/-, 17/6, 21/-, 25/-, 35/-, and upwards. In Silver and Gold for Presentation. Of Stationers, Jewellers, &c. Booklet, post-free, from L. & C. HARDTMUTH, 12, Golden Lane, London, E.C.

New York, 173 Broadway; Paris, 6 Rue de Hanovre; Vienna, 1 Franzensring 20; Milan, Via Rossi 4; Dresden Pragerstrasse 6; Brussels, 14; Rue du Pont Neuf (Ask your Stationer to show you Waterman's Ideal Pump-Filling and Safety Pens—at 12s. 6d. and upwards.)

Established Nearly a Century

HILL & SON,

4, HAYMARKET, LONDON,

Manufacturers of

Sporting, Table, Toilet & Pocket Cutlery.

ALPINE ICE-AXES; SKATES,

AND FINE STEEL WORK GENERALLY.

Practical Dodgy Utilities for Home Requirements and Travellers' Use.

Reliable English-made Goods at Moderate Prices.

CHOLERA WAS AVOIDED

by the BRITISH TROOPS in the recent

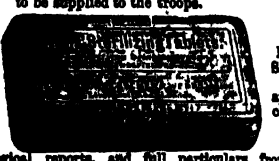
MOHMAND CAMPAIGN

by the use of

Evans' Sterilizing Tablets

specially ordered by the Indian Government to be supplied to the troops.

In three sizes, 1s., 1s. 6d., 3s.



Free Sample on application.

Bacteriological reports, and full particulars from the proprietors, 60, BARTHOLOMEW CLOSE, LONDON.

Telegraphic Address—"ZEITGEIST, LONDON." Telephone—4284 GERRARD.

EDWARD STANFORD,

Geographer to His Majesty the King.

Government Map Depôt: 12, 13, and 15, LONG ACRE, LONDON, W.C.

DEPARTMENTS.

PUBLISHING.—Maps and books arranged for and published. Estimates and terms on application.

MAP SELLING.—This department includes the productions of every map publisher of repute both at home and abroad, including the ORDNANCE and GEOLOGICAL Survey Maps, and the ADMIRALTY CHARTS, with the Pilots and Sailing Instructions which accompany them.

MAP MOUNTING OF ALL KINDS done on the premises by skilled workmen.

MAP ENGRAVING.—This department includes Drawing, Lithography, and Engraving of all kinds. Edward Stanford's large collection of copyright Maps is available for transfers for book illustration, etc. Estimates given.

BOOK SELLING.—The best Guide Books, Works of Travel, and all standard Geographical Works are kept in stock. Books of any sort supplied.



DOULTON'S

1909 Patent

TRAVELLER'S PUMP FILTER

ASSURES

Pure Drinking Water

Vide *British Medical Journal* and *Journal of Hygiene.*

OBTAINABLE THROUGH ALL STORES AND OUTFITTING HOUSES.

ROYAL DOULTON POTTERIES,

Lambeth, London, S.E.

DELICIOUS COFFEE.

RED WHITE & BLUE

For Breakfast & after Dinner.

NOTICES.*

Ordinary Meetings during May and June.—Wednesday, May 4 (Special Me To the North Pole and Back. By Rear-Admiral R. E. Peary.—**Monday, M** The Land of the Incas. By Sir Clements R. Markham, K.C.B.:—**Monday, M** Anniversary Meeting.—**Monday, June 6.**—The Yola-Cross River Boundary mission, Southern Nigeria. By Major G. F. A. Whetlock, R.E. Journe Southern Nigeria. By P. A. Talbot.—**Monday, June 20.** Glaciers and Work. By Prof. E. J. Garwood.

Research Department, Thursday, May 26.—The Burial of Olympia: a St Climate and History. By Ellsworth Huntington. These Meetings are open Fellows of the Society.

Anniversary Dinner.—The Anniversary Dinner will be held in the Wh Rooms in the evening of May 23, at 7.30 p.m. Fellows wishing to attend apply for tickets, price one guinea, to the Chief Clerk, 1 Savile Row, W. F may bring guests.

Conversazione.—The Annual Conversazione will be held at the Natural H Museum on **Friday, June 17.** Cards will be sent to all Fellows.

Year-book for 1910.—The Year-book for 1910 is nearly ready, and c obtained on application to the Chief Clerk, 1 Savile Row, W. Price, to F 1*s.*; to non-Fellows, 2*s.* 6*d.*

Fellows' Reading-room.—The front room on the first floor of the Society'i is arranged as a Reading-room for Fellows. On a few days of the year it required for Meetings of the Council, on which occasions a notice will b outside the door of the room.

Any Fellow desiring to have notice of the subjects of papers to be read Society's Meetings forwarded to him, can receive such notices by post on pa in advance to the Chief Clerk, at 1, Savile Row, of 2*s.* per session.

* See also pp. vi., viii., and x.

WRIGHT'S
COAL TAR SOAI

is acknowledged as an

ABSOLUTE SPECIFIC

in warding off the bites of

Mosquitos and Other Insects.

"VERB. SAP. ON GOING TO WEST AFRICA," say "Wright's Coal Tar Soap is good for Prickly Heat and refreshi to the skin."

For Travellers it is packed in an Enamelled T Box, containing one Tablet, price 5d.

If any difficulty in obtaining, please write to
The Proprietors of WRIGHT'S COAL TAR SOAP,
48, Southwark Street, London S.E.



BERKEFELD" FILTER

YIELDS

Absolutely Pure and Germ Free Water.

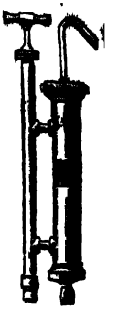
IN USE ALL OVER THE WORLD.

General Sir James Willcocks, D.S.O., in the *Empire Review*, says:—

"One word more regarding Camp Equipment and I have done. Whatever may or may not be taken, it is absolutely necessary to have a couple of portable filters, and the 'Berkefeld' is the best."

THE BERKEFELD FILTER CO., LTD.,

121, OXFORD STREET, LONDON, W.



ORIENT CRUISE FOR WHITSUNTIDE.

TO

PORTUGAL
BALEARIC ISLANDS
SPAIN
MOROCCO and
GIBRALTAR

By Twin-Screw Steamer "OTRANTO," 12,124 tons Register.

Leaving LONDON 13th May.

Arriving back 30th May.

17 Days for 15 Guineas and upwards.

NORWAY.

The SS. "OMRAH" and "OPHIR" will make a series of Cruises to Norway commencing 24th June, 15th and 30th July, 13th and 27th August.

Managers { F. GREEN & CO. / ANDERSON, ANDERSON & CO. } Head Office: Fenchurch Avenue, London, E.C.

For Passage apply to the latter firm, at 5, Fenchurch Avenue, London, E.C.; or to the West End Branch Office, 28, Cockspur Street, S.W.

MARTIN BEHAIM:

HIS LIFE AND HIS GLOBE.

By E. G. RAVENSTEIN, F.R.G.S.

An exhaustive Memoir with numerous Illustrations and Coloured Maps, and a Facsimile of Behaim's Famous Globe, printed in 15 Colours on 4 Sheets, 24 by 30 inches.

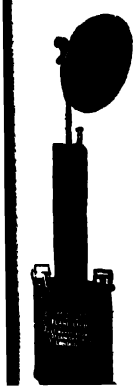
Large 4to, antique cover, gilt top, enclosed in cardboard case.

PRICE £3 3s. NET.

THE EDITION IS STRICTLY LIMITED TO 516 NUMBERED COPIES.

Detailed Prospectus with facsimile on application.

GEORGE PHILIP & SON, Ltd., 32, Fleet Street, London, E.C.



PORTABLE

ACETYLENE LIGHTS.

Easy to carry. Easy to handle. Easy to understand.

No attention required after lighting.

FOR TRAVELLERS. PROSPECTORS. PIONEERS.

For all Countries and all Climates.

FLARE-LIGHTS each 500 to 5000 c.p. HAND-FLARES 250 to 1000 c.p.
Not affected by Weather. Will stand a Gale.

HAND-LAMPS 100 c.p. HAND-LANTERNS 20 c.p.

PORTABLE GENERATORS complete in one casing for 2 to 20 lights.

Full particulars from the Patentees and Sole Makers—

[illegible] WIDDIDY & CO. 27, CANNON STREET.

NOTICE.

PHOTOGRAPHS.

ROYAL GEOGRAPHICAL SOCIETY

It would greatly add to the value of the Collection of Photographs w has been established in the Map Room of the Royal Geographical Societ all the Fellows who have taken photographs during their travels, w forward copies of them to the Map Curator, by whom they would be ackn ledged. Should the donor have purchased the photographs, it will be u for reference if the name of the photographer and his address are given.

POTTER'S

Catalogue (84 pp) of

Books on Travel and Sport

(chiefly new copies at greatly reduced prices)

SENT POST-FREE.

WILLIAM POTTER,

30, Exchange Street East, Liverpool.

BOUGHT CAMERAS EXCHANGED

ILLUSTRATED BARGAIN LISTS POST

NEW CAMERAS for OLD CAMER

We make the exchange.
Let us have your propositio

THE WESTMINSTE PHOTOGRAPHIC EXCHANG

111, OXFORD STREET, 115, VICTORIA STREET, LON



SKINNER & GRANT,

TAILORS,

59, REGENT STREET, LONDON,

(7 Doors from Piccadilly Circus).

BEST GOODS AT MODERATE PRICES.

Frock Coat and Vest	from	£4	4 0
Morning Coat and Vest	,,	3	10 0
Lounge Suits	,,	3	10 0
Trousers	,,	1	1 0
Overcoats	,,	3	3 0
Dress Suits	,,	5	5 0

MOTOR COATS A SPECIAL FEATURE. A TRIAL ORDER SOLIC

Telephone No. 5197 Gerrard

MARTIN, HOOD & LARKIN,

MAP SPECIALISTS,

Lithographers and General Printers,

8, Gt. NEWPORT ST., LONDON, W.C.

ALL KINDS OF

Maps, Plans and Charts

NATURAL HISTORY

WATKINS & DONCAST

NATURALISTS

36, STRAND, LONDON, W

(Five Doors from Charing Cross)

keep in stock every description of Appar Cabinets, Books, and Specimens for Collect

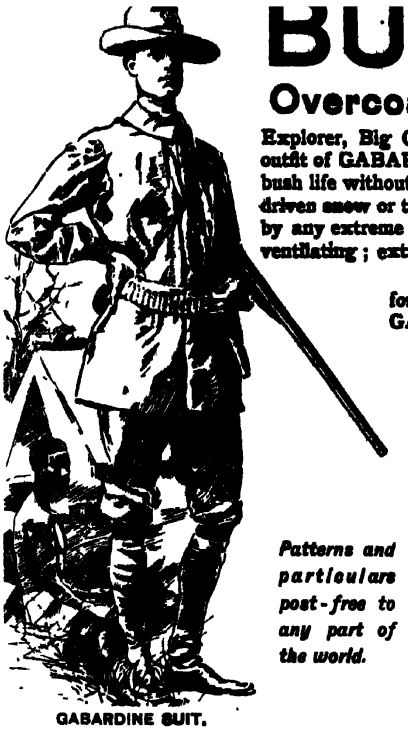
BIRDS' EGGS, BUTTERFLIES A MOTHS, &c.

BURBERRY

Overcoats, Suits and Tents.

Explorer, Big Game Hunter, Mountaineer or Colonial with an outfit of GABARDINE has that which will stand the rigours of bush life without showing signs of wear, and keep out blizzard-driven snow or tropical downpours. The proofing is not affected by any extreme of climate; it is wind-proof yet faultlessly self-ventilating; extremely light, yet so strong as to be untearable.

Such union in numbers of the great essentials for comfort in camp life is to be found in GABARDINE AND GABARDINE ONLY.



GABARDINE SUIT.

Patterns and particulars post-free to any part of the world.



GABARDINE TENTS.
Extremely light, imperishable, and non-absorbent.

BURBERRYS, 30 to 33, Haymarket, LONDON.

J. & J. LEIGHTON, BOOKSELLERS AND BOOKBINDERS,

ESTABLISHED 1798.

40, BREWER STREET,
Golden Square, Regent Street, London, W.

Illuminated MSS., Incunabula and other Early Books with Wood-cuts, Bookbindings of Historical and Artistic Interest, etc., etc.

ILLUSTRATED CATALOGUE, 7,500 items, with upwards of 2,060 facsimile reproductions in line and half-tone, with full descriptions and bibliographical information.

SPECIMEN PART WITH PROSPECTUS, POST FREE ON APPLICATION.

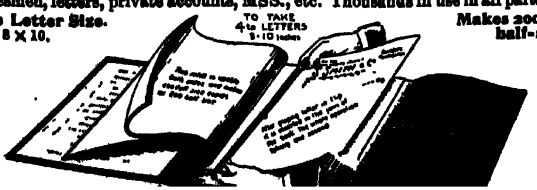
The Zanetic Pat. Copying Book

To copy letters while writing, you simply place your writing paper in the Zanetic copying book and write as usual. The Act of Writing produces the copy. Extremely useful for keeping copies of orders to tradesmen, letters, private accounts, MSS., etc. Thousands in use in all parts of the world.

Order as No. 20/100 Letter Size.
To take letters 8 × 10.

4/9 complete.
Weight 1lb. 14oz.
Refills 1/6 each.
Weight 12oz.

The simplest, yet the most efficient and economical of all copying systems.



Makes 200 full size or 400 half-size copies.

If 200 leaves 5/6, refills 2/3 each. Note size: 100 leaves 3/6, refills 1/3 each; or if 200 leaves 3/9, refills 1/6 each.

Samples of Zanetic copying paper free

NOTICE.

INSTRUCTION FOR INTENDING TRAVELLERS.

Under the authority of the Council of the R.G.S.

Arrangements have been made for the instruction of intending travellers in the following subjec
Surveying and Mapping, including the fixing of positions by Astronomical Observations.
Mr. E. A. REEVES, F.R.A.S., Map Curator of the Society.
Geology, including practical training in the field. Under the superintendence of the Dire
General of the Geological Survey.
Botany. Under the superintendence of the Director, Royal Gardens, Kew.
Zoology.
Anthropological Measurements. Under the superintendence of Dr. J. G. GARSON, Anth
logical Institute
Photography. By Mr. JOHN THOMSON, Author of 'Photographic Illustrations of China an
People,' and other works.
Meteorology. By Dr. H. R. MILL.
Outfit and Health. Dr. CHARLES F. HARFORD, Secretary of the Travellers' Health Bureau
The Lessons are given on days and at hours arranged between the Instructor and the pupil. Th
for the lessons, at 2s. 6d. for each hour's lesson, must be previously procured at the Offices of the So

Silvertown

India Rubber, Ebonite, & Gutta Percha Good
of all Descriptions.
WATERPROOF GARMENTS and FABRICS.

The India Rubber, Gutta Percha & Telegraph Works Co
Limited.

Head Offices - - 106, CANNON STREET, LONDON, E.C.
Works - - - - SILVERTOWN, LONDON, E.

BRANCHES:
HOME: Belfast, Birmingham, Bradford, Bristol, Cardiff, Dublin, Glasgow, Liverpool, Manchester, Newcastle, Portsmouth, Sheffield.
ABROAD: Adelaide, Brisbane, Buenos Ayres, Bulawayo, Calcutta, Christchurch (N.Z.), Durban, Johannesburg, Melbourne, Perth (W.A.), Sydney.

CLARKSON'S
SECOND-HAND OPTICAL MART,
338, HIGH HOLBORN, W.C.
(Opposite Gray's Inn Road).

Sextants, Theodolites, Surveyors' Instruments, Prism Binoculars, Telescopes, and other Second-hand Optical Instruments by the best makers.
Telephone: 2148, HOLBORN.

All communications respecting Advertisements in the
"GEOGRAPHICAL JOURNAL"
to be sent to

Use Odourless or Germici
FLORIGEN
(A Registered Name suggested by FLOOR HYG
On all School, Laboratory, Library, Mus
Studio, Office, and other Floors—either V
Linoleum, Stone, Concrete, or Polished
—for the anhydrous
LAYING of DUST
Each application lasts for two to six months, acc
to wear. The ordinary daily sweeping alone re
to clean the floors—no scrubbing (*unless prefer*
sprinkling of any kind—therefore no injurious mo
The "DUST-ALLAYER"
65, Queen Victoria Street, London

TRAVEL IN COMFORT.

SELECT CONDUCTED TOURS

VISITING

BRUSSELS EXHIBITION,
SALZKAMMERGUT and OBERAMMERGAU,
The DOLOMITES and OBERAMMERGAU,
SWITZERLAND,
GERMANY, AUSTRIA and HUNGARY,
NORWAY, DENMARK and SWEDEN,
etc., etc.

Fares provide —Travel Tickets—Superior Hotel Accommodation—Sight-seeing -Rail and Hotel Servants' Fees—Drives by Private Landaus—Services of Competent Representatives (not in uniform), etc., etc.

Synopsis or Illustrated Booklets, post free.

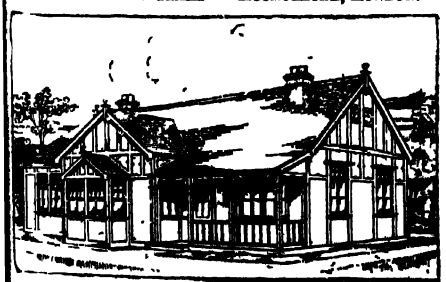
THOS. COOK & SON,

LUDGATE CIRCUS, LONDON, AND BRANCH OFFICES.

W. HARBROW,

IRON BUILDING WORKS,
S. Bermondsey Station, S.E.

TELEGRAMS—"ECONOMICAL, LONDON." TELEPHONE—HOP. 17.



DESIGN No. 287.

BUNGALOW, specially designed for Tropical Climates. Excellently well ventilated. Large Living Room, Four Bedrooms, Scullery, and Store.

PRICE: Delivered F.O.B. London, prepared for re-erection, including all key plans, **£189.**

Ant-proof foundation columns and steps provided at an extra cost of **£21.**

DESIGN 139a.

BUNGALOW, containing Drawing-room, Dining-room, Three Bedrooms and usual Offices.

Constructed of timber framework, roofing red diagonal asbestos tiles, walls "Rough Cast" plastering.

PRICE £280,

including foundations, chimneys, and fittings.



300-page Catalogue of Churches, Chapels, Mission Halls, Bungalows, Cottages, Billiard Rooms, Stores, Rifle Ranges, Club Rooms, Farm Buildings, Sheds, Gymnasiums, Aeroplane and Motor Garages, &c., **Post Free** on mentioning this publication.

Special Export Catalogue. Manufacturer of every description of Church Furniture and Joinery. Buildings Shipped and Erected in any part of the World.

ROYAL GEOGRAPHICAL SOCIETY.

THE SOCIETY'S PUBLICATIONS.

THE GEOGRAPHICAL JOURNAL. Issued Monthly. Delivered free to all Fellows; price 1
Fellows, 2s.

GENERAL INDEX TO THE FIRST 20 VOLUMES OF THE GEOGRAPHICAL JOU
1893–1902. 650 pages, double columns. Price, to Fellows, 2s. 6d. net; to Non-Fellows, 10s. 6d.

JOURNAL OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1830–18
volumes, 8vo. Price, to Non-Fellows, £1 per vol. net; to Fellows, 15s. per vol.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 18
22 volumes, 8vo. In parts, to Non-Fellows, 1s.; to Fellows, 9d. per part.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (NEW SERIES), con
14 volumes, extending from 1879 to 1892.
Each volume covers on an average 840 pages, the selling price being 18s. per volume. These volumes constitut
of exploration and geographical work in all parts of the world. In the 14 volumes there are some 360 ma
numerous illustrations of characteristic scenery in the least-known parts of the world. It is believed that a
set of the *Proceedings* would be a valuable addition to public libraries and other institutions, while ma
individuals might wish to have the volumes. The series is now offered, bound in cloth, at £6 per set.

SUPPLEMENTARY PAPERS.
Containing a large number of Memoirs and Narratives of considerable length, besides several valuable Bibli
over 30 Maps and numerous Illustrations. Sold for half price, £2 for the four volumes.

HINTS TO TRAVELLERS.—The ninth revised edition, edited, under a Committee of the
by E. Reeves, F.R.A.S., Map Curator and Instructor to the Society. Price 15s. net; to Fellows, at the Ho
Society, 10s.

TRIGONOMETRY—PLANE AND SPHERICAL. Specially arranged for the use of Student
ing the Royal Geographical Society's course of Instruction. By E. A. Reeves, F.R.A.S. Price 5s. net.

HINTS ON OUTFIT FOR TRAVELLERS IN TROPICAL COUNTRIES. By Charles
Harford, M.A., M.D. Price 1s. 3d. net.

CATALOGUE OF THE LIBRARY OF THE R.G.S. Edited by Dr. H. R. Mill.
Fellows, 2s. 6d. net; to Non-Fellows, 5s.

THE YEAR-BOOK OF THE SOCIETY. Issued annually. Price, to Non-Fellows, 2s. 6d.; Fe

SYLLABUSES OF INSTRUCTION IN GEOGRAPHY. I. In Elementary Schools. II. In S
Schools. Single copies gratis on application at 1, Savile Row, W.

EXTRA PUBLICATIONS.

THE FIFTY YEARS' WORK OF THE ROYAL GEOGRAPHICAL SOCIETY.
Clements R. Markham, K.C.B., F.R.S., President. 285 pp. Price, to Non-Fellows, 5s. net; to Fellows, 2s

THE LANDS OF CAZEMBE. LACERDA'S JOURNEY TO CAZEMBE IN 1798. T
and annotated by Captain R. F. Burton. 271 pp., with Map. Also Journey of the Pombeiros, P. J. Ba
Amaro José, across Africa from Angola to Tette on the Zambese. Translated by B. A. Beadle. And a *Rés*
Journey of MM. Monteiro and Gamitto. By Dr. C. T. Beke. Price, to Non-Fellows, 5s. net; to Fellows, 2s.

THE TOPOGRAPHY OF THE BATTLE OF PLATÆA. By G. B. Grundy, B.A. Pri
in half-calf, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

NOTES ON THE KURIL ISLANDS. By Captain H. J. Snow. 8vo, 88 pp., with two larg
revised by Captain Snow. Price, in boards, to Non-Fellows, 4s. net; to Fellows, 2s. net.

EASTERN PERSIAN IRAK. By General A. Houtum-Schindler. 8vo, 182 pp., with Ma
to Non-Fellows, 5s. net; to Fellows, 3s. net.

A JOURNEY ON THE UPPER MEKONG, SIAM. By H. Warington Smyth. Sixty Ill
and three Maps. Price, to Non-Fellows, 7s 6d. net; to Fellows, 4s. net.

BIBLIOGRAPHY OF ALGERIA, FROM THE EXPEDITION OF CHARLES V. IN
1887. By Sir R. L. Playfair. Price, to Non-Fellows, 7s. 6d.; Fellows, 5s. net.

EDUCATIONAL REPORTS. By Dr. J. Scott Keltie. Price, to Non-Fellows, 5s.; to Fellow

SUPPLEMENT TO THE BIBLIOGRAPHY OF ALGERIA, FROM THE EARLIES
TO 1895. By Sir Lambert Playfair, K.C.M.G. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

MAP OF THE KARAKORAM HIMALAYAS. In two sheets, with text. By Sir W.
Conway, M.A. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

SURVEYING AND EXPLORING IN SIAM. By James McCarthy. Large Maps of
many Illustrations. 236 pp. 8vo. Price, to Non-Fellows, 10s. 6d. net; to Fellows, 6s. 6d. net.

THE DISTRIBUTION OF RAINFALL OVER THE LAND. By Dr. A. J. Herbertso
to Non Fellows, 5s. net; to Fellows, 2s. 6d. net.

ON THE RESULTS OF A DEEP-SEA SOUNDING EXPEDITION IN THE
ATLANTIC DURING THE SUMMER OF 1899. By R. S. Peake, M.Inst.C.E. With Notes on Tempera
Sea Deposits, &c. By Sir John Murray, K.C.B., F.R.S. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d.

ARCTIC PAPERS FOR THE EXPEDITION OF 1875. A selection of Papers on A
graphy and Ethnology. Reprinted and presented to the Arctic Expedition of 1875, by the President, C
Fellows of the Royal Geographical Society. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 5s. net.

THE ANTARCTIC MANUAL, FOR THE USE OF THE EXPEDITION OF 190
by George Murray, F.R.S. 602 pp. royal 8vo. Price, to Non-Fellows, 15s. net; to Fellows, 10s. net.

JOURNEY TO LHASA AND CENTRAL TIBET. By Sarat Chandra Das, C.I.E.
the Hon. W. W. Rockhill. Maps and Illustrations. 285 pp. 8vo. Price, bound in cloth, to Non-Fellow
net; to Fellows, 7s. net.

NEW MAP OF THE RIVER CONGO, in Ten Sections on Five Sheets. Scale 1:
miles = 1 inch). By the Rev. George Grenfell. In small portfolio, with Memorandum. Price, to N
10s. net; to Fellows, 6s. net.

ON RECENT CONTRIBUTIONS TO OUR KNOWLEDGE OF THE FLOOR OF THE
ATLANTIC OCEAN. By Sir John Murray, K.C.B., F.R.S., and R. E. Peake, M.Inst.C.E. Price, to Non-
net; to Fellows, 2s. 6d. net.

AN EXPEDITION INTO THE CENTRAL TIAN-SHAN MOUNTAINS. By Dr. G
Merzbacher. Price, to Non-Fellows, 12s. net; to Fellows, 9s. net.

MAP OF TIBET. New edition, 1906. Price, to Fellows, 3s. net; to Non-Fellows, 5s. net.

GEOGRAPHICAL DISTRIBUTION OF VEGETATION IN SOMERSET. By Dr. C.
Price, to Fellows, 2s. 6d. net; to Non-Fellows, 5s. net.

BIBLIOGRAPHY OF TOPOGRAPHICAL AND GEOLOGICAL WORKS ON THE PHIL
FIELDS. By R. T. Günther. Price, to Fellows, paper covers, 2s. 6d., boards, 3s. net; to Non-Fellows, p
5s., stiff boards, 6s. net.

NATIONAL ANTARCTIC EXPEDITION, 1901–4. Charts of the Expedition, with Memoir
G. F. A. Mulock, R.N. Price, to Non-Fellows, 12s. 6d. net; to Fellows, 9s. net.

MOUNTAIN PANORAMAS FROM THE PAMIRS AND KWEN LUN. With Introd

The Statesman's Year-Book.

Statistical and Historical Annual of the States of the World, for the Year 1910. Edited by J. Scott Keltie, LL.D., Secretary to the Royal Geographical Society. Crown 8vo, 10s. 6d. net. [*Immediately.*

The statistical and other information in the new edition of the Year-Book has throughout been brought up to date. In cases where it has seemed desirable, foreign money, weights and measures have been converted into English equivalents. As far as possible, the changes consequent on the Union of South Africa have been embodied. The chapter on China has been considerably improved, especially in the sections dealing with education and provincial government. The results of the action of the French Chamber with reference to Old Age Pensions have been included. The notice of the Anglo-Egyptian Sudan has been much improved. The introductory matter includes a section on Second Chambers; the results of the Census of Productions, and other information of general interest. There are maps showing the prospective development of the Belgian Congo; the increase of urban and decrease of rural population in the United Kingdom in the 19th century; the proposed Central Scotland ship canal; the proposed Georgian Bay ship canal; United South Africa and South African railways; South American railways (two maps); new Federal District and Capital of the Australian Commonwealth.

MACMILLAN & CO., Ltd., LONDON.

ROYAL GEOGRAPHICAL SOCIETY.

NEW EXTRA PUBLICATIONS.

"Researches on Ptolemy's Geography of Eastern Asia (Further India and Indo-Malay Archipelago)."

By Colonel G. E. GERINI, M.R.A.S.

Published in conjunction with the Royal Asiatic Society. 970 pages, with maps. Price 15s. net; to Fellows, 12s.

This is the result of many years' investigation in Further India and the Indo-Malay Archipelago, by Colonel Gerini, and is one of the most important contributions that have been made to the literature of Ptolemy's Geography.

New Map of Eastern Turkey-in-Asia, Syria, and Western Persia.

On the scale of 1 : 2,000,000, or 32 miles to an inch, with accompanying text, in case, with pocket for map. Price to Fellows, unmounted, 5s. net, mounted in cloth, 6s. 6d. net; to Non-Fellows, unmounted, 8s. 6d. net, mounted, 10s.

This map is based on the most trustworthy recent surveys and explorations by travellers of all nationalities, and may be regarded as the most complete map of the region available.

Copies may be obtained at the Royal Geographical Society,

AERTEX CELLULA

This Label on All Garments.



The Use of Red Ga in the Tropics.

IT has been definitely proved by profession that the sun's rays in act very forcibly, but that it is the (known scientifically as the actinic) wh sunstroke, and that the red rays (kn non-actinic rays) do not have any ha Heat alone is not injurious, as is evide fact that persons can stand high temperatures in Turkish baths, and stokers stay for days in boiler-rooms, witho effect, but heat together with strong sunshine often result in disaster. We have therefore produced a special AERTEX fabric which is not a bluish-red, but is so carefully selected as to colour, that only the red and orange rays to act on the body. The great comfort derived from the wearing of AERTEX Garments in hot countries will, w still further increased by the substitution of AERTEX Garments made from red yarns which have been chemicall proved to be able to withstand the actinic rays. We are therefore confident these garments will meet a great r are admirably adapted for tropical use.

Suggestions from Medical men for fabric or garments specially suited for local requirements are respectfully

NON-ACTINIC AERTEX CELLULAR.

Neck Sizes 14 to 17.

Day Shirt (soft throughout) **6/6**

Tennis Shirt, with Collar and Pocket .. **7/-**

Tunic Shirt, Soft Front, Laundered L Cuffs and Neckb

Day Shirt, with Small Linen Front Round Linen C

WHOLESALE ONLY

THE CELLULAR CLOTHING CO., Ltd.,

72 and 73, FORE STREET,

LONDON, E.C.

Cable Address: "CELLULAR," LONDON. A.B.C. Code used.

Telephone: 838, London Wall.

AERTEX Cellular is entirely of British Manufacture.

LONDON RETAIL AGENTS—

City: ROBERT SCOTT, Ltd., 8, Poultry, Che

West End: OLIVER BROTHERS, Ltd., 417, O

Full Price List of Aertex Cellular Goods for Men, Children sent post free on application

Any Garments mentioned in price list may be o the above-named Agents, who keep a compl AERTEX Cellular Garments and Fabrics.

All materials may be obtained at the above add yard, any length cut. Very light fabrics specially n for the tropics.

Special study is given to Outfits for India and Estimates for complete outfits furnished at short n

---

USED BY DOCTORS and the PUBLIC for OVER HALF-A-CENTURY.

Dr J. Collis Browne's Chlorodyne

The ORIGINAL and

The Best Remedy Known for

COUGHS, COLDS, ASTHMA, and BRONCHITIS.

Acts like a Charm in

DIARRHŒA, CHOLERA, and DYSENTERY.



ONLY GENUINE.

Admitted by the Profession to be the

MOST VALUABLE REMED

ever discovered.

Effectually cuts short all attacks of **SPASMS.**

The only Palliative in

NEURALGIA, TOOTHACHE, GOUT, RHEUMATISM.

Convincing Medical Testimony accompanies each bottle.

SOLD IN BOTTLES BY ALL CHEMISTS,

at 1/1½, 2/9, and 4/6 each.

INDEX TO ADVERTISEMENTS.

Where no number is given, the Advertisement does not appear this month.

PAGE

Account Book Makers.
Brown & Rowley .....

Bookbinders, Booksellers, &c.
Leighton, J. & J. 7
Sotheran & Co. ..... *Cover* 2

Boots and Shoes.
Dowie & Marshall 13
Goodyear-Welted .....

College.
Thames Nautical Training ...

Cutlery.
Hill & Son 3

Electrical Engineers.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd. ... 3

Electric Lighting.
Tredegar & Co. .....
Wakefield & Co. 5

Filters.
Berkefeld 5
Doulton & Co., Ltd. 3

Foods for Travellers.
Bovril ..... *Cover* 2
Oxo 14
Red, White & Blue Coffee 3

Fountain Pens.
Waterman's Ideal Fountain Pen 3

Furniture and Floor Polish.
Ronuk, Limited 16

Hotels and Restaurants.
Hôtel Métropole 15
Hotel Seehof, Arosa 15
Hotel Victoria, Bale 15

Instruments for Travellers.
Cary, Porter, Ltd. .....
Clarkson & Co. 8

Insurance.
Eagle Insurance Co. ..... *Cover* 3
London and Lancashire .....
Scottish Provident Institution ...
Scottish Widows' Fund .....

PAGE

Medicines & Medicine Cases.
Browne, Dr. Collis 12
Burroughs Wellcome & Co. *Cover* 4
Dinneford & Co. .....
Evans, Lescher & Webb, Ltd. ... 3
Mussatol .....

Naturalists.
Watkins & Doncaster 6

Outfitters.
Cellular Clothing Co. 12
Dowie & Marshall 13
Griffiths, McAlister & Co. .....
Silver, S. W., & Co., and Benjamin Edgington .....
Thresher & Glenny .....
Tucker, Joseph ...

Pencils.
Koh-i-noor .....

Photo Engravers.
Bale, Sons, & Danielsson, Ltd. *Cover* 2

Photographic.
Burroughs Wellcome & Co. .....
Newman & Guardia .....
Westminster Photo Exchange .. 6

Portable Buildings.
Harbrow, W. 9

Publishers.
Constable & Co. Ltd. .....
Heinemann, Wm. ..... *Facet*
Macmillan & Co., Ltd. 11
Murray .....
Philip, G., & Son, Ltd. 5
Potter, Wm. 6
Stanford, Edward 3
Travel and Exploration .....
Witherby & Co. .....

Railways.
Great Central Railway .....
Great Eastern Railway .....

Razors.
Kropp Razor ..... *Cover* 2

PAGE

Soaps.
Wright's Coal Tar 4

Sporting Outfits.
Burberrys 7

Stores for Expeditions, &c.
Griffiths, McAlister & Co. .....
Silver, S. W., & Co., and Benjamin Edgington .....
Spratt's Patent, Ltd. .....
Tucker, Joseph .....
Wilkinson Sword Co. .....

Stoves.
Poore, Wm., & Co. 15

Tailors.
Skinner & Grant 6

Tents.
Burberrys 7
Piggott Bros. & Co., Ltd. .....
Silver, S. W., & Co., and Benjamin Edgington .....
Tucker, Joseph .....

Tobacco.
Player & Sons .....

Tours and Excursions.
Cook, T., & Son 9
Orient Line 5

Turkish Baths.
Nevill's, Charing Cross 13

Typewriters.
Blick 14
Oliver Typewriter Co., Ltd. .....
Remington Typewriter Co. .....

Wines and Spirits
Denis & Geldermann ..... *Cover* 4
Heidsieck, Charles ..... *Cover* 4
Martell & Co. .....

BOOTS FOR EXPLORERS.



(REGISTERED AT STATIONERS' HALL.)

DOWIE & MARSHALL

(Established 1894)

Have for many years made a special study of the various kinds of boots required for different climates, and they have had the gratification of pleasing many Travellers, including members of the R.G.S., from the time of Dr. John Rae of Arctic renown to Sir H. M. Stanley, the African Explorer.

Country Customers should send, as guide to measurement, a pair of old boots and outlines of the foot.

Only the best hand-sewn Boots are made

455, WEST STRAND, LONDON.

E.P.O. Telephone No. 9015 Central. (3 doors from Trafalgar Square.)

CHARING CROSS TURKISH BATHS

Northumberland Avenue.

NEVILL'S.

SEPARATE BATH FOR LADIES OPEN ALL DAY.

Also at LONDON BRIDGE, BROAD STREET, CITY, Etc., Etc.

TRAVELLERS

will find the "Blick" the most portable, reliable, and hardest-weari Typewriter on the market. It has been called the Special Corresponden "light-weight travelling companion," and has stood the test of rough trav ling through the South African veldt, the wilds of Klondyke, China, t Congo, Soudan, and "The Forbidden Land." The

"BLICK"

ALUMINIUM MODEL.



A marvel of lightness—weighing only 5 lbs. Beautifully finished in every deta aluminium model is *par excellence* the Typewriter for those whose work takes them a and who want a writing machine that they can put in their bag and use anywh any time.

Price Eleven Guineas. Cash Discount or Easy Terms.

REFERENCES GIVEN TO USERS IN EVERY PART OF THE WORLD.

Write for Booklet No. 85.

The BLICKENSDERFER CO., LD., 9 & 10, Cheapside, Londo

OXO

for explorers

The great value of OXO to explorers lies in the fact that it contains the nourishment of beef in compact form. It is easily prepared and is ready in a moment. As a nourishing food in case of illness, it is unsurpassed. OXO is a scientific blend of beef extract which stimulates, and beef fibrin which nourishes.

And OXO is guaranteed pure—it is made by the OXO Company throughou from ranch to bottle. *OXO differs fro other fluid beefs in that all raw materi used comes from OXO's own cattle.* No one single ounce of raw material is bough from an outside source. This is important because the OXO Company thus hav complete control over its manufacture and are able to guarantee absolute purit and healthiness.

OXO, 4, Lloyd's Avenue, London, E.C.

The

Geographical Journal.

No. 5. MAY, 1910. Vol. XXXV.

THE TRAVELS OF A BOTANIST IN SOUTH-WEST AFRICA.*

(Percy Sladen Memorial Expedition, 1908–9. Report No. 1.)†

By H. H. W. PEARSON, M.A., Sc.D., F.L.S., Professor of Botany in the South African College, Cape Town.

The primary object of this expedition was to obtain material of *Gnetum africanum*, one of the three members of the phylum Gnetales known to occur in South-West Africa. In so far as was compatible with this quest, it was proposed to examine the flora of the dry regions of South-West Africa, mainly with reference to the relationships of the vegetation of the desert fringing the coast of Namaqualand, Damaraland and South Angola with that of contiguous areas. A visit to the montane forest region of Angola lying behind the port of St. Paul de Loanda was especially concerned with the search for Gnetum, and few observations of a phytogeographical nature were made; all reference to this part of the work of the expedition is therefore omitted from the following account, which deals mainly with the regions lying south of the latitude of Mossamedes.

Parts of this region have been visited by many botanical travellers within the last century. Prominent among these are Welwitsch, whose work in South Angola is memorable in the annals of botanical exploration; Schinz, whose long and arduous journey in Great Namaqualand, Damaraland, Ngamiland and Ovamboland has greatly enriched our knowledge of the vegetation of these countries; and Paterson, who crossed Little Bushmanland more than a century ago. But the region, even as limited in a preceding sentence, is so vast, and much of it so difficult of access—indeed, there are large areas into which the white

* Royal Geographical Society, January 10, 1910. Map, p. 620.

† Assisted by a grant from the Government Grant Committee of the Royal Society.

man has never penetrated—that our knowledge of the flora as a whole is still too slight to allow a general account of its phytogeography to be given. The first section of this paper, in which an outline of the more striking and obvious facts of geographical distribution is attempted, is designed to make the account of the journey which follows it more intelligible; it will be considerably modified and, in many particulars no doubt, corrected as our knowledge of the vegetation of South-West Africa is enlarged.

A. Outlines of the Phytogeography of South-West Africa.

The watershed separating the western drainage from that which flows eastwards,—either into the Indian ocean or to the lakes, marshes and salt-pans of the central plateau, or, in Namaqualand and Bushmanland, into the lower and middle course of the Orange river—is nowhere more than 200 miles from the west coast. It is broken through by the Orange river, rising mainly in Basutoland and the south-eastern Transvaal, and by the Kunene, whose waters are derived from the Benguella tableland and the eastern slopes of the Shellas. The general features of the country on opposite sides of the divide are, as is well known, very different. On the east there is a series of plateaux (2000 feet and upwards, in elevation) more or less diversified by abrupt hills, while, on the west, the descent is steep and greatly broken until it merges, near the sea, into a low-lying undulating plain which, in many parts, is covered by deep sand and massive sand-dunes.

Eastern Side of the Watershed.—The eastern plateaux vary a good deal in elevation, form of surface, nature of the soil and amount of water-supply, and in the composition of their respective floras. The Karoo, the most southerly of them, like its neighbour to the north, the "Composite" * region, is well known as regards the general characters of its vegetation, though much detailed work yet remains to be done upon both. It is an elliptic basin-like area with an average elevation of about 2500 feet, bounded on the west by the Lange Berg chain and separated from the "Composite" region by a great range known in different parts of its length as the Sneeuwberg, the Nieuwveld and its north-western continuation, the Roggeveld. At its western end the Karoo is continued as a narrow tongue to the north, following the trend of the Roggeveld range, under which it reaches the latitude of 31° 45′ S. (Draai Kraal). Its flora is dominated by fleshy-leaved plants belonging to various families; trees are absent except along the river-beds, where *Acacia horrida* (only occasionally attaining the stature of a tree) and *Rhus viminalis* are fairly common. The extensive range which separates the Karoo from the more elevated plateau to the north ("Composite"

* H. Bolus, 'Sketch of the Floral Regions of South Africa.' Science in South Africa. Cape Town: 1905.

region) connects the Drakensberg and the mountains of the Eastern Transvaal with Namaqualand; it forms an important highway across the sub-continent along which an interchange of Eastern and Western species occurs.

The flora of the "Composite" region is characterized, as its name implies, by the great preponderance of members of the family Compositæ. A considerable number of Karoo succulents, together with a few grasses, are also present. As in the Karoo, trees are absent except in the river-beds. The northern boundary of this region is somewhat indefinite; in its western part, at an elevation of about 3000 feet, it merges gradually into the sandy plains of Little Bushmanland, which fall gently to the north to the level of the Orange river, beyond which lies the Great Kalahari. In general, the flora of the Western Kalahari is that of Bushmanland at corresponding elevations. When the elevation is sufficient, as on hills of 5500–6000 feet in the latitude of Keetmanshoop, species characteristic of the Nieuwveld range and the "Composite" region reappear. The sandy surface of the undulating plains of Bushmanland is interrupted, at shorter or longer intervals, by large extruded blocks of gneiss with sand-polished surfaces, or by hills strewn with angular blocks. Owing to the irregularity of the rainfall, this country is without settled inhabitants, except in the neighbourhood of the Orange river, but districts which are favoured by rain are usually resorted to by farmers with their flocks and herds, from more arid regions to the south and west. In ordinary seasons travel in Bushmanland is attended by great difficulty, owing to the scarcity of surface-water and of food for the transport animals.

Dr. Rogers states that the geology of this great tract of country is known only in its barest outlines. A great part of the surface is occupied by acid igneous rocks which extend across Little Namaqualand and Bushmanland. The sand of Bushmanland "is derived from the minerals composing the gneissose granite that occupies such wide areas there. Quartz and felspar are the chief constituents, and, by the breaking up of the granite under the influence of the great diurnal change of temperature . . . the minerals are set free to be carried about by wind and rain. The sand is pink, owing to the abundance of red felspar, and also of the iron oxide derived from the ferrugineous constituents of the igneous rocks biotite, hornblende, hypersthene and magnetite." * The sand is very deep, and, in some places,—as between Aggennys and Pella, and on the Wolftoon above Henkriesfontein—is thrown into high dunes. Of the natural history of this region comparatively little is known. On the plains there is a considerable development of grasses—mainly species of Aristida—with which is usually found, sometimes in abundance, a leguminous bush or small tree, *Parkinsonia africana*. Scattered

* A. W. Rogers, 'The Geology of Cape Colony.' 1905.

bushes of *Rhigozum trichotomum*, *Senecio longiflorus*, and two or three species of Euphorbia resembling the latter in habit, occur with some frequency, especially round the bases of the hills. The curious Asclepiad, *Hoodia Gordoni*, with thick water-storing stems and large saucer-like flowers, is a characteristic plant over wide areas. Trees are few, and are practically confined to the vicinity of the water-holes, *Acacia Giraffæ*, *Euclea Pseudebenus*, a species of Ficus and a Rhus (*Rozynbosch*) being the most conspicuous. On the hills the flora is, in the main, that of the western mountains of Namaqualand. North of the Orange river, the genus Acacia plays a part in the composition of the flora, which gradually becomes more important. In the latitude of Windhoek (which lies a few miles to the west of the watershed) this genus predominates among the bushes, and, to a smaller extent, also among the trees, and this holds probably for the whole of the southern part of the plateau of Damaraland and Ovamboland.* With the Acacias occur various other species of tropical affinity including *Combretum primigenium*, *Ficus dammarensis*,† etc. The same Acacia flora extends to the east towards Lake Ngami, with the omission of certain species (e.g. *A. albida*†), and with the inclusion of northern forms which are stated not to occur further west; such are palms (Hyphæne), *Adansonia digitata* (Baobab), and Sterculias.

A little south of lat. 20°, in Ovamboland, is the southern limit of a leguminous tree, *Copaifera Mopane*, which becomes a very important constituent of the open forest on the lower slopes of the Shella range in South Angola. These forests (north of the Kunene) also include several Acacias, among which the southern species, *A. albida* (the "ana" tree), occurs somewhat rarely. In more open spaces are found Baobabs, palms (two species of Hyphæne), Sterculias, figs and other trees. An epiphytic orchid (*Ansellia sp.*) is fairly common, and woody climbers of the families Menispermaceæ and Asclepiadaceæ occur not infrequently. The undergrowth includes several small Acanthaceous bushes and, in the summer rainy season, a large number of grasses. A forest of the same type clothes the lower slopes of the Shella range on its western face.

Western Side of the Watershed.—The strip of country lying on the west side of the watershed and extending northwards from the mouth of the Oliphants river, varies considerably in breadth, its narrowest part being probably through the so-called "Kaokoveld" which constitutes the seaboard in the northern part of German territory. The flora of the low-lying littoral desert belt differs in many respects from that of the more mountainous zone which separates it from the watershed. In the south, the montane flora includes that remarkable tree

* Galton, 'Narrative of an Explorer, etc.' Minerva Library: 1889.
† Schinz, 'Süd-West Africa.' Leipzig: 1894.

Aloe dichotoma, which ranges from Brak Rivier (lat. 31° 15′ S.) in little Namaqualand, into the tropics. At Haigamkhab (lat. 22° S.) and farther north in the Khan river-basin,* it is less abundant than in the south, and this, together with its comparatively meagre habit, suggests that it is here not far from its northern limit. With it there occur *Vogelia africana*, *Eucomis albicans*, *Vahlia capensis*, low-growing species of Bauhinia, various Acanthaceous and Amarantaceous bushes and other peculiar forms. In Angola, Damaraland and Northern Namaqualand, the transition from the montane zone to the littoral desert is perhaps indicated by the presence of certain species of Vitis (Vines), which, on account of their tuberous stems, fleshy leaves and non-climbing habit, have been placed by Engler in a distinct section of the genus. Among these species are *V. macropus*,† *V. Bainesii*, and *V. Cramerianus*,† the first in South Angola, the two latter in Damaraland and Northern Namaqualand, at elevations between 1000 and 2500 feet. Further south they appear to be replaced by various species of Euphorbia—"Euphorbia-steppe" of Schinz ‡—occurring between 2500 and 3000 feet in Namaqualand. In Damaraland and the northern part of Great Namaqualand, the Acacia park-forest of the plateau descends for some distance on the western side of the watershed.

The desert littoral is a low-lying plateau, frequently sand-covered near the sea. Over large areas in the southern part of Great Namaqualand, the sand has been removed by the wind, leaving behind a stony surface, from which, in the districts south of Lüderitzbucht, diamonds are now being obtained. Elsewhere the sand has been heaped up in large dunes such as those which occupy nearly the whole of the British territory of Walfish bay. In Little Namaqualand these littoral sands bear a fairly rich flora, in which many species of Mesembrianthemum, Compositæ, Amarantaceæ, Asclepiadaceæ, Euphorbiaceæ and bulbous plants are conspicuous, and from which trees are absent. Near the mouth of the Orange river the vegetation becomes very sparse and the sand-dunes along the banks are said to be exceedingly barren. Just north of the river a few Bushmen and Hottentots live on its produce and on the fruits of that remarkable Cucurbitaceous plant, *Acanthosicyos horrida*, which is endemic in the South-Western African littoral. But it is generally believed that this species does not occur naturally so far south, but has been introduced here by the natives.‡ Its true southern limit is said to be not far from the southern extremity of Walfish bay; it is reported to occur almost as far north as Mossamedes in South Angola. Perhaps the most characteristic species is *Welwitschia mirabilis* which ranges between lat. 27° and 14° S. With these occur also, at wide

---

* Pearson in Kew Bulletin, 1907.

† *Botanical Magazine*, T. 5479.

‡ Schinz, *l.c.*

intervals, *Statice scabra*, Euphorbias, a few Composites, Leguminosæ, Ficoideæ, species of Tribulus, etc.

Where the mountain-tops rise above the general level of the watershed and exceed 5000 feet, there occur isolated developments of floras which are naturally centred in more southern localities. The presence of a "Composite" region flora between 5500 and 6000 feet at Schakalskuppe in Great Namaqualand has already been mentioned. On the Huilla plateau (6000–6500 feet) in South Angola, on the Kamies Berg * (6000 feet) in Little Namaqualand, and perhaps also on other ranges of high elevation (*e.g.* Omatako, 8700 feet, in Damaraland, Auas Berg south of Windhoek and the Karas Berg in Namaqualand) the vegetation is distinguished by the presence of Proteaceæ and of other forms which, with them, constitute the dominant features of the flora of the Cape region; the latter effects a junction with the coast region of Namaqualand in the neighbourhood of the mouth of the Oliphant's river.†

B.—An Account of the Journey.

The route of the expedition from Cape Town to the coast of Great Namaqualand crossed, in turn, the Cape region, the northern arm of the Karoo, the "Composite" region, the Namaqualand Montane region, Little Bushmanland, the Orange river belt, the south-western fringe of the Great Kalahari, the main watershed (between Shakals Kuppe and Aus) and the littoral desert, reaching the sea at Lüderitzbucht. Thus far I travelled in company with my colleague, Dr. J. C. Beattie, to whom, and to the courtesy of the Director of the Department of Magnetism of the Carnegie Institute of Washington, I am indebted for permission to use Dr. Beattie's determinations of latitude and longitude made in connection with the magnetic survey, in the preparation of the map which accompanies this paper.

In Damaraland and in South Angola, the desert strip was crossed in the opposite direction; in the latter region the journey was continued up the western slope of the Shella range, across the Huilla plateau and down to Fort Rosadas on the eastern bank of the Kunene river.

Ceres to Karoo Poort. Nov. 27 *to Nov.* 30, 1908. *Cape Region.*—The waggon journey commenced at Ceres Road railway station situated at the foot of the Lange Berg range in the valley of the Breede river. After ascending Mitchell's pass through this range to the Ceres plateau (1100 feet) the Calvinia road winds over an undulating plateau rising here and there to 3000 feet. The country suffers from frequent droughts, one of which occurred in 1908, and is sparsely populated. It is mainly a grazing district supporting a considerable number

* [illegible]oth, 'Report of the British Association,' 1905.
† Bolus, *l.c.*

of ostriches, sheep and goats. Horse-breeding is carried on to some extent. Wheat and oats are cultivated on a limited scale—the latter principally for fodder. The indigenous flora is of the same type as that which flourishes in the more mountainous districts of the Cape region but appears to be much poorer in species. Proteaceæ and other typical forms are more especially characteristic of the higher ground. Along the roadsides and elsewhere where the natural vegetation has been trampled or burnt out, a dense scrub of the Rhenoster Bush (*Elytropappus Rhinoceroti*) has taken possession of the land and has rendered it of little value for grazing or for agricultural purposes. Succulents become more abundant as the Karoo is approached; there are clear indications that the practice of burning the veldt, which appears to be widespread, leads to the disappearance of many natural species and their partial replacement by more resistant forms or by Karoo succulents, of a lower economic value. From Hottentots' Kloof the track follows a valley which ends in a gap in the hills (Karoo Poort*) beyond which it emerges abruptly upon the Karoo at about 2000 feet.

Karoo Poort to Draai Kraal, Nov. 30 *to Dec.* 6. *Karoo.*—From Karoo Poort to Draai Kraal, the road traverses a depression which, at Stompies Fontein, falls as low as 800 feet. Always dry, this arm of the Karoo was at this time a monotonous arid waste, over many parts of which the drought had been unbroken for so long as four years. The waters—surface-drainage collected in natural hollows or shallow pits, or derived from weak springs and in this case disagreeably impregnated with sulphuretted hydrogen—were 20 miles or more apart; they were generally impure and frequently fetid. Near the water-holes, the soil is usually rich in soluble salts, and halophytic vegetation is common. Prominent among this is frequently an extensive development of *Suæda fruticosa* from which the few white inhabitants obtain a substitute for ink. Away from these localities the flora is of a different character. On rocky ground near Karoo Poort there flourish many species characteristic of the western part of the Karoo near Matjesfontein. Among these may be mentioned a remarkable Crassulaceous tree, *Cotyledon fasciculariis*,† and other representatives of the same family, a Euphorbia, in habit resembling *E. mauritanica*, and various Mesembrianthema, including *M. crystallinum*. Lichens are common. *Acacia horrida* and *Rhus viminalis*, *Galenia fruticosa* and the grass *Ehrharta spinosa* occur in sandy patches along the dry river-beds. Further north the effects of the severe drought became more obvious. Large stony patches were quite destitute of vegetation, or bore a

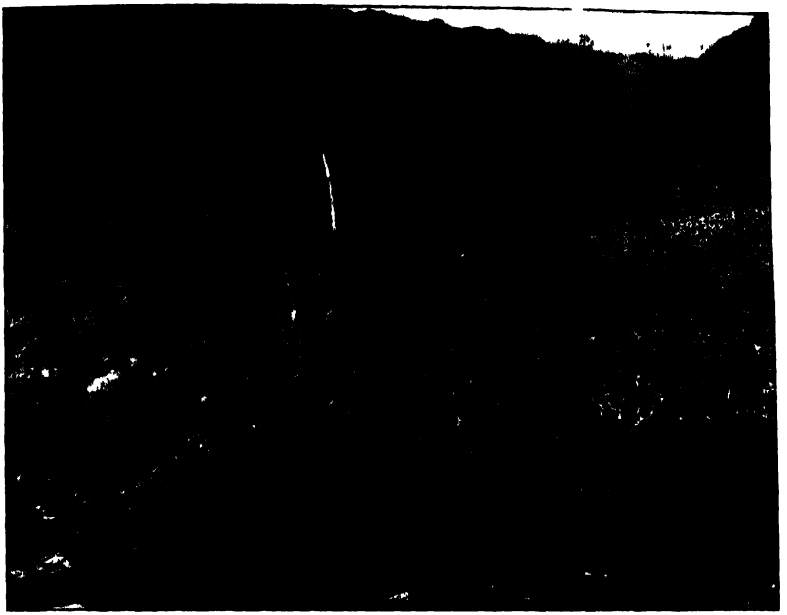
* This pass lies north and west of that described by Burchell under the same name. Burchell, W. J., 'Travels in the Interior of Southern Africa,' vol. 1, p. 207. London: 1822.

† Yapp in *New Phytologist*, vol. 5, 1906, Pl. 6, Fig. 1.

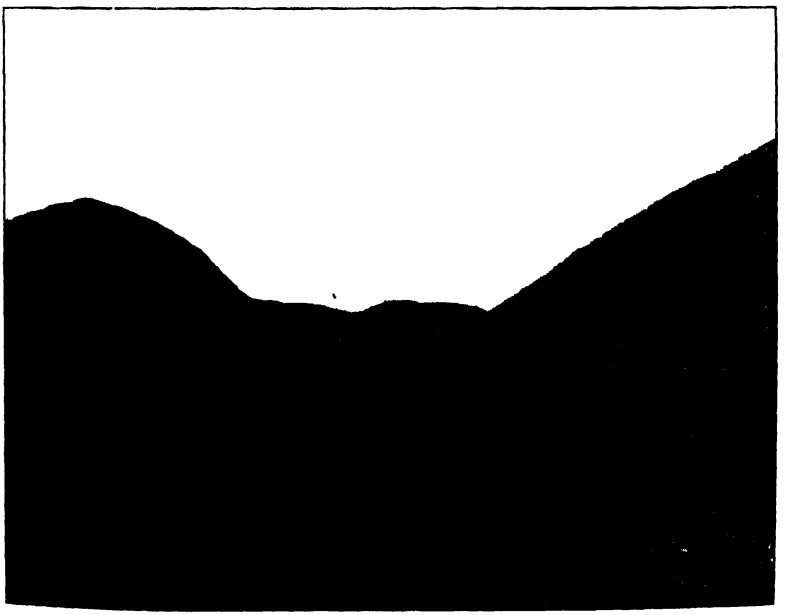
scattered array of Mesembrianthema or the curious Zygophyllaceous succulent, *Augea capensis*. Dead plants of *Euphorbia spp.*, *Codon africanum*, *Sarcocaulon sp.*, a succulent supposed to be *Hoodia africana*, *Galenia fruticosa* and some composites, were common. Many of the barren areas were undoubtedly saline, but in other cases no signs of salinity could be detected, and then it seemed that *Augea capensis* and species of Mesembrianthemum were the last to yield to the excessive drought; when these succumbed the ground was left untenanted. This extremely barren stretch of country is very sparsely populated, and, of the few farms seen, perhaps the majority were temporarily abandoned by their occupiers who, with their livestock, had "trekked" into Bushmanland and elsewhere in search of food and water. The stock consists almost entirely of sheep and goats with a few ostriches. The country is quite unsuited to oxen and our own team suffered severely from want of fresh food during the six days occupied in crossing it. The donkey is the most successful draught animal. Of cultivation there is, of course, very little and this is practically confined to the river-beds. Here are grown under irrigation, wheat, rye, mealies (*Zea Mays*), potatoes, pumpkins, figs and dates. In addition to the more serious difficulties of travelling due directly or indirectly to want of water, dust and flies are an almost intolerable nuisance.

Draaikraal to Loeries Fontein, Dec. 6 *to Dec.* 12. *Karoo, "Composite" and Namaqualand Montane Regions.*—A sudden rise of about 1000 feet through a pass (locally known as the Blaukrantz) leads from Draai Kraal through a spur of the Roggeveld range to the plateau on which Calvinia is situated. The flora becomes much richer, especially in Composites, while succulents decline in importance; on rocky ground towards the top of the pass, lichens, crustaceous and foliose, are very abundant. The species are in many cases the same as those found on the Nieuwveld range near Beaufort West. For a considerable distance north of Calvinia, at elevations of 2500 feet and upwards, the flora is that of the "Composite" region. Below this, in mountainous districts, the vegetation is mainly that of the Namaqualand Montane region; but where the surface is less broken Karoid species or Bushmanland grasses predominate. The existence of one or other of these floras seems to depend primarily upon elevation; certain other factors, especially perhaps the nature of the soil, are also important.

Away from the high ridge of the Roggeveld, towards Calvinia, the effects of severe drought were again marked, and the vegetation was poor. One of the most remarkable plants found in abundance north of Calvinia was a minute Helichrysum ("Everlasting"), gregarious over large areas, whose white indumentum glistened in the sunlight like the distant gleam of snow. In the vicinity of Calvinia, Mr. Van Dijk has carried on, for some years, very successful experiments in the cultivation of lucerne; he now has about 60 acres under irrigation along the



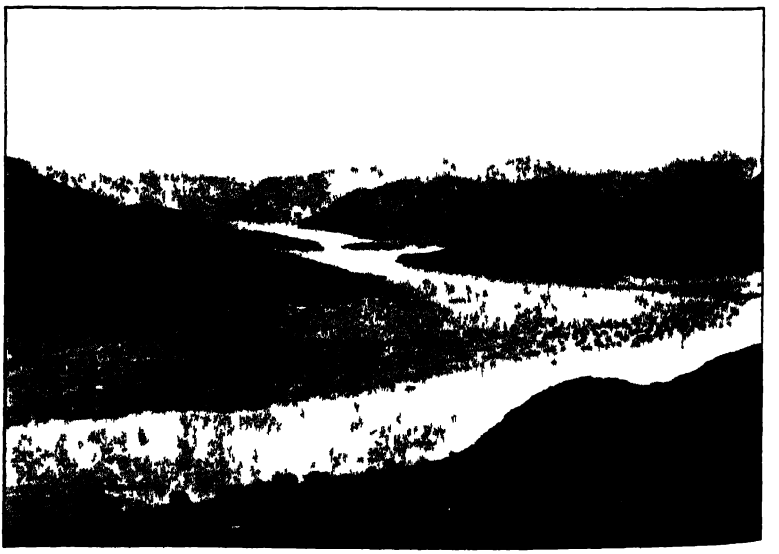
BUSHMANLAND. A VIEW FROM A HILL NORTH OF KWEEKFONTEIN, LOOKING SOUTH-WEST. *ALOE DICHOTOMA* (LEFT CENTRE) AND *COTYLEDON FASCICULARIS* (RIGHT) IN FOREGROUND. THE ALOE IS 15 TO 20 FEET HIGH.



BUSHMANLAND. DABAINORIS. *EUCLEA PSEUDEBENUS* AND *TAMARIX ARTICULATA* NEAR THE WATER-HOLE IN THE MIDDLE DISTANCE. PACHYPODIUM OCCURS ON THE LOW SCHISTOSE HILL ON THE LEFT.



BUSHMANLAND *PACHYPODIUM NAMAQUANUM* AT DABAINORIS A COMMIPHORA IS SEEN ON THE RIGHT BEHIND THE PACHYPODIUM THE NATIVE IS A BONDELZWART



ORANGE RIVER AT RAMAN'S DRIFT, LOOKING NORTH. THE BRITISH STATION IS SEEN IN THE FOREGROUND; THE GERMAN ON THE OTHER SIDE OF THE RIVER. THE [illegible] WARMBAD FOLLOWS THE SANDY VALLEY SEEN IN THE MIDDLE [illegible]

Oorlog river. By careful treatment, as many as six good crops are obtained from a single sowing. It is used as fresh food and fodder for ostriches, horses, mules and small stock. It is probable that this crop will prove to be of great importance in this district, which suffers so severely from the failure of rainfall. Other crops include salt bushes and various vegetables and fruits. Among the latter are peaches, pears, oranges, lemons, grapes and water-melons. Another introduced plant, more or less under cultivation, is a Mediterranean Tamarix which furnishes fuel and small wood. Common weeds include *Asclepias fruticosa* and an Opuntia (prickly pear).

North of Holle Rivier the road to Loeries Fontein frequently passes over tracts below 2500 feet; here are encountered southern extensions of the Namaqualand Montane flora. The first example was seen in crossing the bed of the Klein Doorn Rivier, about 20 miles north-west by west from Calvinia; a still more marked case was found 6 miles further on at Brak Rivier (1600 feet), where, in addition to many species of Karoo and "Composite" region affinity, there occurred *Tamarix articulata*, *Aloe dichotoma*, *Statice scabra*, *Vogelia africana*, *Exonis albicans*, several species of Zygophyllum and a Ficus. Most of these and other equally characteristic species are common throughout the Montane or littoral regions of Namaqualand and extend northwards beyond the tropic into Damaraland.

Cattle were met with to the north of Brak Rivier, but south of Loeries Fontein the stock consists mainly of sheep, goats and ostriches; mules and donkeys are the common draught-animals. The small Dutch hamlet of Loeries Fontein is situated on a branch of the Kromme Rivier, periodically a stream, uniting lower down with the Doorn which reaches the sea by way of the Oliphant's river. It is an agricultural settlement with 100 or 150 white inhabitants, and is surrounded by extensive fields of wheat and oats. The drought here had been far less severe than farther south. In the immediate neighbourhood of the hamlet, the deep-cut ravines are bounded by steep cliffs of a black, crumbling, shaly rock in thin horizontal layers. These support a poor flora; here and there a trickle of water exudes and maintains a fairly luxuriant growth of Adiantum and other mesophytic plants and even a few reeds.

Loeries Fontein to O'okiep. Dec. 13 *to Dec.* 27. *Namaqualand Montane region and Bushmanland.*—From Loeriesfontein the road to Nieuwe Fontein descends at first in the bed of the Kromme river and afterwards across a series of sandy plains towards a southern spur of the Lange Berg* range. After crossing this, it emerges upon an extensive plain with a uniformly sandy surface, lying to the south-west of the main extent

* This range is quite distinct from the more important one of the same name previously mentioned (see p. 486).

of the range. This plain slopes gently down to a huge granite rock with a flat top, beneath which is a small supply of water at the bottom of a shallow excavation (1600 feet). This rock gives the name Plaat Klip to the locality, in which, at the time of our visit, the only inhabitants were a family of "Trek-Boers." The flora of the Lange Berg is very rich, its most conspicuous elements being *Aloe dichotoma* and many other forms characteristic of the Namaqualand Montane region; the genus Commiphora was represented by a species apparently closely related to *C. saxicola* of the Welwitschia desert in Damaraland. *Hoodia Gordoni* was very numerously represented on the sandy plains on both sides of the mountain range. Many other succulents and several halophytic species were present, but a severe drought had prevailed for some time and the vegetation was in poor condition.

Between 15 and 20 miles beyond Plaat Klip, while the vegetation still maintained many Namaqualand features, a marked change, due to an increase in the proportion of grasses (chiefly species of Aristida), occurred. This indicated the commencement of the Bushmanland flora. Secretary birds were here seen for the first time. For some distance beyond this point the road became heavy and the waggon wheels sank deep into the sand. The guide missed the way, and for three days the oxen were without water and suffered severely. During the night of Dec. 17, the fore part of the lightly laden waggon had to be unloaded before it could be extricated from the deep sand of a dry river-bed in which it had stuck fast.

From Plaat Klip to within a few miles of Nieuwe Fontein the plains were dried up and much of the vegetation was represented only by dead specimens. A few small geophytes were in flower, and one minute annual—a Helichrysum—was collected. On the hills, the species which had withstood the drought were all of Namaqualand affinity. Nieuwe Fontein (2700 feet), a small Dutch settlement of about half a dozen houses, has a small supply of fairly good water, but its very unsanitary conditions make it an extremely unpleasant place to stay in. As at the majority of the water-holes of Namaqualand and Bushmanland, the water-supply is uncared for and the ground surrounding it for a mile or two on every side is trampled bare of vegetation by the stock resorting to it. The latter includes cattle, sheep, horses, donkeys, geese and hens. These travel far in the surrounding country in search of food. In the immediate neighbourhood of the settlement the country was extremely bare, and the presence of many dead perennials showed that this was due, at least in part, to the severity of the drought and not entirely to goats. The flora appears to be of a somewhat complex character; it includes many Composites and other forms whose affinities are with the "Composite" region, Bushmanland grasses and, in rocky places, *Vogelia africana* and other species of Namaqualand relationships. An Agave is used in the settlement as a hedge plant; in the very

unpretentious gardens were seen Pepper trees (*Schinus molle*), *Nicotiana glauca*, a Hollyhock and a low-growing species of Erythrina.

Rain in these regions occurs in the summer and is usually an accompaniment of thunderstorms, and therefore presumably very local in its distribution. This, no doubt, accounts for the very limited areas of the fertile patches in which the vegetation is in good condition. It was a common experience, after travelling for hours over a dry stretch in which the perennial species were mostly dead and from which annuals were absent, to enter suddenly a region in which the vegetation was in full activity and the surface sprinkled with flowers. A little to the north of Alewyn's Fontein (2900 feet) the ground was almost as barren as the Namib; no living grasses were seen, and even of so resistant a species as *Mesembrianthemum crystallinum*, very few plants were left alive. A few weeks earlier, it was stated, the whole of this district had been green with young grasses. The contact of the Namaqualand, Karoo, Nieuwveld, and Bushmanland floras was well shown on December 23 about 20 miles north of Alewyn's Fontein. On a wide plain at about 3200 feet, a shrubby grass (*Aristida namaquensis?*), a common species on sandy ground throughout western Bushmanland, was the predominant plant. A mile to the west of the outspan there was a sudden fall of about 500 feet, through very broken country, into the bed of the periodical river Kansaap. On the rugged slopes, occurred a flora which included species found also on the Nieuwveld mountains, some succulents, especially Cotyledons and Mesembrianthema, together with *Aloe dichotoma* and other Namaqualand forms. A similar admixture was found in the remarkably broken country surrounding the waterhole of Kamabies (3000 feet), where no rain had fallen for five months, and where consequently but few annuals and other delicate forms were obtained. Here, as in many other localities, the fact that dry mountainous country is commonly rich in species and poor in individuals, while on flat ground the converse is usually found, was well illustrated.

The full development of the characteristic flora of Little Bushmanland was first encountered a few miles south of Rietfontein (2300 feet). Three very typical species were present, two in great abundance, viz. the shrubby Aristida already mentioned and a bushy species of Mesembrianthemum (allied to *M. spinosum*), while the leguminous bush *Parkinsonia africana*, afterwards so common, was represented by a few struggling specimens, this locality being probably very near its southern limit. On the hills, the Namaqualand montane species still prevailed; around their bases was a fairly dense growth of a smooth, thick-stemmed Euphorbia, believed to be an undescribed species, which has been experimentally used by a Namaqualand firm for the extraction of rubber. A curious habit of growth was observed in many of the perennial sand-loving species here and afterwards more abundantly throughout Bushmanland and Great Namaqualand. Conspicuous among

these were *Zygophyllum lichtensteinianum*, *Aristida sp.* and *Asparagus sp.* The plant, once established, throws out rhizomes in all directions, and eventually all the living shoots are arranged in a circle round a sandy centre beneath which lie the older dead parts of the plant. The general arrangement reminds one of the fairy rings of the mushroom; in this case it may be due partly or entirely to the exhaustion of certain mineral constituents of the soil in the "atolls." The dead vegetation in the centre, lightly covered by sand, must undoubtedly play an important part in conserving the moisture deposited as dew.* Rietfontein, as its name implies, is a reed-girt series of springs, in the broad sandy bed of the Riet river, a tributary of the Doorn river. Under the energetic and skilful management of a firm whose principal members are respectively of Huguenot and Scotch † descent, cultivation under irrigation in this river-bed has been attended with conspicuous success. Here are produced crops of wheat, lucerne, figs, dates, plums, peaches, apricots, grapes and pomegranates. The hedges are of quince. The loquat (*Eriobotrya japonica*) is in cultivation, but is not promising well at present. Amarantaceæ play an important part in the composition of the flora to the north of Rietfontein.

At Rietfontein our transport broke down completely. Twelve of the team of twenty oxen were dead or abandoned, and those that remained were in a weakened and emaciated condition. It was therefore necessary to proceed in a hired cart to O'okiep, and there to make fresh arrangements for the next stage of the journey, while our own waggon came in at a slower pace. We crossed a watershed from south-east to north-west (Baviaan's Kloof) soon after leaving Rietfontein, and followed a road through a mountainous country in which the slopes bore the Namaqualand Montane flora, while the narrow valleys were mostly under cultivation. Springbok, the capital of Namaqualand and the headquarters for the district of the magistrate and the Cape Mounted Police, is a village whose interests are mainly in agriculture and stock-farming; there is also a small copper-mine worked by the Cape Copper Company. The railway projected to connect it with O'okiep, about 6 miles to the north, is not yet built. O'okiep (3050 feet) is the headquarters of the Cape Copper Company. Its white inhabitants, who are almost entirely English or of British descent, are chiefly engaged directly or indirectly in the extraction of copper from the surrounding hills; it is also the centre of an extensive native trade throughout Namaqualand and Bushmanland. The settlement is situated about 8 miles west of the watershed, beyond which lies Bushmanland; it is connected with the coast at Port Nolloth by a light

* *Cf.* 'Tunic Grasses,' Hackel, *Verh. Zool.-Bot. Ges. Wien*, 1890.

† Mr. Kennedy, an old man, who, with his family, is quite ignorant of English. His father emigrated from Aberdeen and was probably the Kennedy mentioned by Sir James Alexander, *l.c.*, pp. 69 and 85.

railway through Steinkop, the northern terminus of the Cape Telegraph system. This railway, the property of the Cape Copper Company, was largely used as far as Steinkop for the transport of supplies to the Germans during the recent war with the Bondelzwarts. From Steinkop the goods were carried, mainly by ox-waggon, over the Orange river at Raman's drift to Warmbad. The copper ore is carried by rail from O'okiep to Port Nolloth and thence shipped, chiefly in sailing-vessels, to South Wales.

O'okiep to Pella, Jan. 3 to Jan. 8, 1909. Namaqualand Montane Region and Bushmanland.—For a somewhat rapid journey through Little Bushmanland, a light waggon drawn by a team of ten mules was employed. These animals travel faster than oxen, and are of great service in dry districts. But, if they are to be kept in good condition, the waggon must be partly laden with corn for their use, and this is consequently a more expensive form of transport than the ox-waggon. The summer of 1908–09 brought rain to many parts of western Bushmanland, and although its distribution showed curious limitations as in districts farther south, the vegetation on the whole was fairly vigorous. The scenery, picturesque but monotonous, is characterized by extensive stretches of sand, bearing a flora poor in species as well as in individuals, and interrupted at short or longer intervals by sharply outlined hills whose height rarely exceeds 1000 feet, and at the bases of which there is usually a great development of Euphorbias. The water-holes are usually situated at the foot of a hill, at or near the lowest point of a wide sloping plain. They are shallow excavations, from which a copious supply is, however, frequently obtained. Such water-holes are sometimes many miles distant from one another; certain roads can only be used after a rainfall sufficient to fill natural or artificial depressions with surface drainage. There can be no doubt that water for irrigation purposes could be obtained in many parts of Bushmanland by judicious boring operations. Except during one of the frequent sandstorms, the air is remarkably clear, and even during the summer when the mid-day heat is intense, the climate is very healthy and invigorating.

The general features of the flora have already been described (see p. 483). *Parkinsonia africana* is a common constituent of the Aristida steppe. Frequently the grasses are dominated or almost replaced by a bush steppe composed mainly of the Bignoniaceous *Rhigozum trichotomum*, in company with a large-flowered Hermannia which attains a height of 2 to 3 feet. *Hoodia Gordoni* is a characteristic plant over large areas; its fleshy stems are eaten by the natives when other water-supplies are not available. Trees are rarely met with; they occur only in depressions so situated as to receive the underground drainage of a large area. *Acacia Giraffæ* (the camel-thorn) was first observed at Aggennys and was quite common at Pella. Aggennys is remarkable

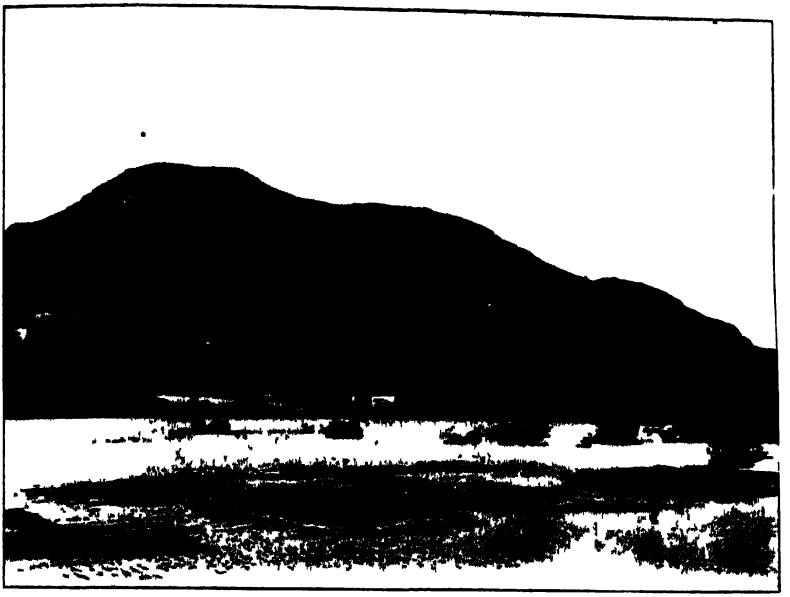
for the great development of a Euphorbia steppe consisting almost exclusively of a single species at present undetermined. The same species occurs again in great abundance on sandstone near Zandverhaar, in Great Namaqualand. The mountains around Aggennys bear a rich flora of Namaqualand affinity; a Ficus forms a tree 25 feet high. A Commiphora—probably the species already referred to (p. 490)—is common on the rough hills at Ougrabies.

Pella (1600 feet), some 6 miles south of the Orange river, is at the lowest point of an extensive sandy plain, where it is bounded by an abrupt range of hills behind which lies the Orange river. It is the seat of a Roman Catholic mission, around which a Hottentot settlement has grown up. It has a copious water-supply from a boring 20 feet deep. The extensive gardens are well stocked with good fruit trees, which, however, are not successful after a few years, when their roots have reached calcareous strata, said to occur only a few feet beneath the surface. The mission has recently started the cultivation of cereals and fruit trees on the south bank of the Orange river. The water for irrigation is obtained from the river by steam-pumps burning wood fuel.

Pella to Steinkop, Jan. 8 *to Jan.* 16. *Bushmanland, Orange River, Namaqualand Montane Region.*—Around the water-hole at Dabenoris (1500 feet) were several trees of the black ebony (*Euclea Pseudebenus*), the camel-thorn and a thick scrub of *Tamarix articulata*. On the top of the great mountain mass of Dabenatup, to the north-west of the water-hole, is a heliograph station, one of the links in the chain of communications between the police camp at Raman's drift and Springbok. On the lower hills at its foot, growing in community with *Aloe dichotoma*, *Commiphora sp.*, and a few other species, was found that very remarkable Apocynaceous succulent, *Pachypodium namaquanum*, discovered, perhaps on the same hills, by Lieut. Paterson in 1779.*

The bed of the Orange river between Pella and Raman's drift lies in a gorge enclosed between steep mountain slopes, rising 1000 to 1500 feet above it, which, viewed from a short distance, appear to be quite arid and bare of vegetation. A closer examination reveals the presence of a few trees of *Aloe dichotoma* and clumps of the thick ridged stems of *Euphorbia virosa*, a species occurring also in similar situations in the ravines of the lower Swakop, in Damaraland. A few specimens of a small bushy Asclepiad and some struggling shrubs of *Bauhinia garipensis* almost complete the flora found above the level of the sandy valleys. A zone a few yards wide, on either side of the river along the water's edge, is covered with a fairly dense bush which includes *Salix capensis*, *Acacia horrida*, *Zizyphus mucronata*, *Euclea Pseudebenus*, *Tamaria articulata* and a few shrubs, perennial grasses and sedges; otherwise the flora of the river-

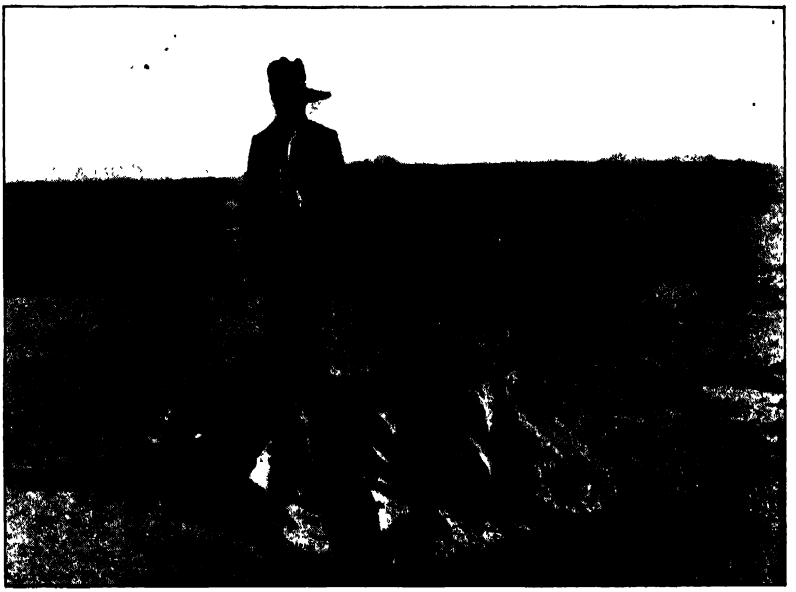
* See Pearson in *Gardeners' Chronicle*, 46 (1900), p. 369, fig. 162.



ORANGE RIVER AT RAMAN'S DRIFT, LOOKING SOUTH. THE RIVER (ABOUT 600 YARDS WIDE) IS CONSIDERABLY ABOVE THE NORMAL LEVEL, AND IS NOW SUBSIDING. THE BRITISH STATION IS SEEN ON THE OTHER SIDE, POLICE CAMP ON THE RIGHT, CUSTOM HOUSE SHED IN THE MIDDLE, FERRYMAN'S HOUSE ON THE LEFT. THE PRECEDING PICTURE REPRESENTS THE VIEW FROM THE LOW HILL TO THE LEFT OF THE POLICE CAMP.



DAMARALAND. A LATERAL RAVINE OF THE KHAN RIVER A FEW MILES ABOVE ITS JUNCTION WITH THE SWAKOP. *WELWITSCHIA MIRABILIS.* THE NATIVE IS AN OVAMBO.



DAMARALAND. THE "NAMIB" NEAR WELWITSCH, ABOUT 3 MILES EAST OF THE KHAN RIVER. *WELWITSCHIA MIRABILIS.*



SOUTH ANGOLA. THE FRONT OF THE SHELLA RANGE AS SEEN FROM KAPANGOMBE, LOOKING EAST, SHOWING THE GAP IN WHICH LIES THE FOOTPATH TO HUMPATA ON THE HUILLA PLATEAU. TO THE RIGHT ARE SEEN AN ANGLE OF THE KAPANGOMBE FORT AND TWO TREES OF AN ACACIA, PROBABLY *A. ALBIDA*. THE LOW VEGETATION IN THE FOREGROUND CONSISTS VERY LARGELY OF GRASSES.

valley is that of a tropical desert. The vegetation between the river-side and the semi-desert plateau in which the river-gorges are cut is therefore of two types, each represented by belts running parallel with the course of the stream. The lower of these, a xerophytic woodland formation, owes its existence to subterranean water derived from the river by infiltration; above this the conspicuous elements of the flora are species characteristic of the Welwitschia desert in the north. The presence of a desert above the fringe of river-side bush seems to be due mainly to the peculiar situation of the river-bed. The sides of the deep gorge in which it lies become intensely heated every day and, at night, the temperature rarely falls below the point of saturation. Clouds and rain are therefore of rare occurrence, even when the neighbouring plateau is visited by thunderstorms. In the after part of the day violent winds commonly sweep up the gorge, carrying with them clouds of sand so dense that the other side of the river is obscured for hours at a stretch; all the loose and light particles are removed from the slopes, and, not only is the power of absorption of atmospheric moisture thus reduced to a minimum, but it becomes impossible for a plant to maintain a foothold except in a crevice of the solid rock. The conditions therefore demand a high degree of xerophytic adaptation, and both the mean and the maximum temperatures are higher than on the plateau in the same latitude.

At Raman's drift, a few feet above the high-water mark, there is a camp of the Cape Mounted Police, which is normally maintained at the strength of one N.C.O. and four troopers. These patrol the river from the drift to the mouth, and for a short distance in the opposite direction towards Pella. A custom-house officer and a ferryman complete the number of the white population. The German frontier station stands opposite. The approach to the drift from each side is overlooked for some distance by the summit of a prominent mountain mass on the opposite bank.

The road from the drift to Henkriesfontein passes all the way through heavy sand, up a broad river-bed and, at length, down the almost precipitous southern face of the Wolftoon. This remarkable formation consists of a number of bosses of gneiss at fairly regular intervals projecting from the top of a high ridge; the hollows between them are partially filled by sand blown up from the plain below. As seen from the south they bear an easily fancied resemblance to the toes of the hyena (wolf). Henkriesfontein is situated at the lower edge of the very extensive plain which supplies the Wolftoon sands, and possesses a fine natural water-supply, said to be the best in Bushmanland. This native reserve is occupied by a few Bastards owning small herds of cattle. There is a large extent of ground capable of irrigation, whose possibilities are even greater than those which have been realised at Pella. The native vegetation shows the characters which

seem to be constant throughout western Bushmanland, viz. a Kalahari flora on the plains, Orange river trees near the water-hole and Namaqualand species on the hills; the latter are much less barren than those bordering the river.

O'okiep to Warmbad. Jan. 18 *to Jan.* 27. *Namaqualand Montane region, Bushmanland, Orange river and Kalahari.*—The most direct transport route between O'okiep and Raman's drift lies between those already indicated—the one passing through Pella and the other through Henkriesfontein. It passes through the copper-mining centre Concordia, which is in communication with the Port Nolloth railway through a junction a short distance north of O'okiep. The road is badly provided with water, the last supply being passed at Aus, 25 miles from the drift. A few miles from the latter place, it runs under the remarkable granite dome known as the "Gesellschap bank" (presumably named from a copper mine situated in its vicinity). This great mass has a polished surface and is almost without vegetation except in a broad rift, filled with loose blocks and rubble, which extends from base to summit. A very similar formation is seen at Kweekfontein and elsewhere in Bushmanland. Gesellschap Bank stands near the upper edge of the broad sandy stretch at the north-western corner of which, some 10 miles away, lies Henkriesfontein. On January 22, the Wolftoon and the hills at the back of Henkriesfontein were hidden from view by a dense cloud of blown sand, which made it easy to account for the great waves of sand in which these ranges were previously found to be enveloped.

On January 24, the Orange river was several feet higher than it had been ten days earlier. It was now at a low flood level and was estimated to be 600 yards wide at Raman's drift. Much of the bush stood some feet deep in water. The current was very rapid and the use of the large "pontoon" (designed to carry a loaded waggon) was consequently impossible. At the same time, so many uprooted trees and dead animals were being hurried down to the sea that the crossing in small boats was attended by some risk. The frontier-line is the high-water mark on the north bank, and therefore the bush on both sides lies in British territory. It is of little economic value; poles of *Zizyphus mucronata* are used in Namaqualand—practically a treeless country—for hut-building. Where the bush has disappeared—apparently in consequence of its exploitation for firewood,—the water's edge is fringed by a luxuriant growth of *Nicotiana glauca*. The small seeds of this plant are deposited in the mud as the water-level sinks, and they quickly germinate. The plants grow rapidly until the water rises again, and it appears that, as soon as the dried mud in which they are growing becomes once more saturated, every plant is killed. The line which separates the living from the dead bushes of this species may therefore be taken as a rough indication of the highest water-level attained since the plants became

established. Various Cucurbitaceæ are under cultivation here and there on the river-banks; their fruits—in particular water-melons—are produced in great profusion and attain a remarkable size.

The German station at Raman's drift is in telephonic communication with Windhoek. Its white population is about equal to that on the opposite side. Several houses erected during the recent war, when much transport crossed the river at this point, are now empty and abandoned. As the new railway south from Seeheim approaches Kalkfontein and Warmbad the importance of the transport route from Steinkop to Warmbad becomes smaller and is no doubt destined to vanish; indeed, it is said that it is only maintained in its present low degree by the high railway rates prevailing on the line from Lüderitzbucht.

The track from Raman's drift to Warmbad ascends through the heavy sand of a river-bed to an elevation of about 2400 feet, near which it remains until Warmbad is left behind. The flora was frequently richer in individuals, and perhaps in species, than that to the south of the river, but the same forms are predominant—it is the flora of the sandy plains of Bushmanland with *Aloe dichotoma* and other Namaqualand Montane species on the hills.

In the neighbourhood of Warmbad, an important military depôt, less rain had fallen than in the surrounding country, and the vegetation was very dry and withered. This appears to be frequently the case. Sir James Alexander in 1836 experienced heavy rain in this region, but he records that "the rain-cloud passed by the unfortunate Bath as usual." * The mean annual fall at Warmbad is about 108 mm.† The settlement, formerly known as Nisbet's Bath, is situated in a slight depression (2340 feet)† on the banks of the periodical stream, the Hom, a tributary of the Orange river. It derives its name from the hot springs which issue in the rocky bed of the river, and yield a copious supply of water (35° C.), strongly impregnated with sulphuretted hydrogen. Fruits (including the date) and various vegetables are grown under irrigation in the river-bed below the town.

Warmbad to Keetmanshoop, Jan. 29 *to Feb.* 11. *Kalahari.*—Eighteen miles north of Warmbad the road ascends slightly to Dabaigabis (Dubbeeknabies of Alexander), and here some change in the flora was encountered. A bush formation—*Rhigozum trichotomum*, *Cadaba juncea*, *Acacia detinens*, shrubby Zygophyllaceæ, *Parkinsonia africana*, *Tamarix articulata*, with trees of *Acacia horrida* and *Euclea Pseudebenus*—occurs, mainly along the dry sandy river-beds. On the flat sandy ground at higher levels, Bushmanland grasses and Mesembrianthema prevail and, with them, scattered but very numerous trees of the camel-thorn, *Acacia*

* J. E. Alexander, 'An Expedition of Discovery, etc.,' vol. 1, p. 202. London: 1838.
† 'Taschen-Buch für Süd-West Afrika, 1909,' p. 225.

Giraffæ; on the branches of this tree are frequently seen the remarkable "colonial" nests of the small finch, *Philetærus socius*.* These are constructed almost entirely of local grasses. Where the soil is saline, grasses are replaced by halophytic and karoid species, such as *Augea capensis*, *Euphorbia spp.*, Mesembrianthema and fleshy-leaved Chenopodiaceæ. Dunes of moving sand are passed at intervals. The road to the north, having the Great Karas Berg within sight to the north, ascends to about 4000 feet, on an extensive sandy plain falling gently to the east. Here the vegetation is markedly karoid; *Aloe dichotoma* is absent from the numerous broken kopjes, and *Acacia Giraffæ* is almost confined to the river-beds.

On descending again to 3000 feet (Sabiesis), *Aloe dichotoma* and *Euphorbia virosa* reappear on the hills and, with them, occurs a small Capparidaceous tree not hitherto met with. The usual Euphorbia scrub occupies the lower slopes; with the latter are found Acanthaceæ (*Blepharis spp.*), Ascelepiads, *Cadaba juncea* and *Bauhinia garipensis*, the latter frequently bears a Loranthus which is very common on various constituents of the Orange river bush. In sandy ground around the water-hole, there occur most of the Orange river trees and shrubs

A short distance north-west from Sabiesis the broad sandy valley up which the road passed, was scored with water-channels of recent origin (February 2), and the vegetation was for some distance remarkably rich. Bushes of *Rhigozum trichotomum* and *Bauhinia garipensis* were in flower and fruit, and the sand and gravel were carpeted with Monsonias, Wahlenbergias, *Tribulus spp.*, small Acanthaceæ, numerous petaloid Monocotyledons, grasses and crowds of young seedlings. But a mile or two farther on, almost the only living plants were large round bushes of the Bushmanland Euphorbia, first seen at Aggennys, closely gregarious over a large area. *Cataphractes Alexandri*, a Bignoniaceous shrub which is very common at higher levels in Damaraland,† occurred here and was frequently seen farther on towards Keetmanshoop. White butterflies, which had appeared in myriads here and there since entering Bushmanland, were still common. At Sabiesis, Seeheim and elsewhere, natural cuttings showed thick beds of sandstone with, here and there, beds of black limestone overlying the igneous rocks; intrusions of dolerite were common. Certain changes in the vegetation corresponding with these differences of geological structure will probably be shown when the collections are worked out. Apart from these, the southern floras persist as far north as Keetmanshoop (3300 feet), where they have already become incorporated with new forms (including species of Acacia) of northern affinity.

At Holoog the ox-waggon was abandoned, and the remainder of the

* Sclater and Stark, 'The Birds of South Africa,' vol. 1, p. 152.

† Pearson, Kew Bulletin, 1907.

journey to the coast was made by rail. Holoog was, in February, 1909, near the southern end of the line from Seeheim, which was expected to be completed as far as Kalkfontein a few months later. It is of the same gauge as the British South African Government railways. Seeheim, a small white settlement which has come into existence with the railway, is situated in the valley of the Fish river, an important tributary of the Orange river. This periodical stream was in flood in February, and some miles' length of the railway, laid practically in the bed of the river, was washed away. Excluding irrigation furrows and the trickles of water originating in various weak springs and ending in small pits of stagnant water, the Fish river was only the second running stream seen since leaving Ceres on November 27, 1908. No other was met with in the further journey to Lüderitzbucht. Keetmanshoop, the eastern terminus of the line from the coast at Lüderitzbucht, is the headquarters of the southern military command. It is a small straggling town, with a large native location, built on a plain dotted with Acacias; most of the other vegetation near the town has been destroyed by stock. To the south-west, about 10 miles away (Gobas), is a range of black limestone hills scored from base to summit by numerous vertical bands of intruded dolerite on which the vegetation is very poor.

Keetmanshoop to Lüderitzbucht, Feb. 12 *to Feb.* 24. *Kalahari, Namaqualand Montane Region, and Littoral Desert.*—The Aggennys Euphorbia is exceedingly abundant on sandstone between Zandverhaar and Buchholzbrunn (3300 feet), and with it grows in some quantity the common Bushmanland species, *Rhigozum trichotomum*. On the hills in the same locality, *Aloe dichotoma* is abundant. Over a wide extent of country between Buchholzbrunn and Kuibis the surface is covered with large angular blocks of quartzite. This tract is almost destitute of bush, and the vegetation is usually composed of grasses, petaloid monocotyledons and small annuals which obtain a roothold in the soil between the quartzite blocks. In the deep gorge 1 mile east of the station at Kuibis, the quartzite can be seen in section capping the gneiss. Stretches of sand and limestone occur here and there. In the sand *Ophioglossum vulgatum* is fairly common, its rhizomes lying a foot or more beneath the surface. In the Kuibis gorge there is a good water-supply, and most of the Orange river trees flourish. In this gorge was formerly one of the trading stations of Lüderitz, the first merchant to penetrate this country from the coast, and after whom the inlet named by the Portuguese "Angra Pequena" is now called Lüderitzbucht. The gorge of the Akkam river lies about 5 miles south of Kuibis, which it resembles in geological structure. Rain had recently fallen and a rich collection of plants was obtained there. At Shakals Kuppe the line ascends to 4800 feet, while the hills in the neighbourhood exceed 5600 feet. All species of Acacia as well as *Aloe dichotoma* are absent. *Rhigozum*

trichotomum, *Tribulus spp.*, *Monsonia sp.*, various Euphorbias and other Bushmanland species occur on the sandy plains; but the hilltops bear many Composites, and the flora is closely related to that of the Nieuwveld mountains in Cape Colony. Shakals Kuppe, whose rainfall normally occurs in March and April, had received rain this year (1909) in January, and the vegetation therefore in February was in an unusually good condition. Large herds of springbok were in the neighbourhood. Wild ostriches were seen on the plains to the west of the ridge, between Shakals Kuppe and Aus. Here, a drought of several months' duration was still unbroken, and the plants were for the most part dried up and wide stretches of ground were bare of vegetation. Shakals Kuppe is situated a little to the west of the limit of the night mists, which occur chiefly during the winter months; the summer fogs do not usually form so far inland as Aus.

Although Aus stands a few feet higher than the railway station at Shakals Kuppe, the higher ground a little to the west of the latter is apparently on the main watershed. West of this line the vegetation becomes more karoid in appearance—a fact which is only partly explained by the absence of annuals due to the drought. On the barren hills around Aus, which previous to February 20, 1909, had been rainless for several months, the predominant species appeared to be the bushy Mesembrianthemum which occurs in abundance in some parts of western Bushmanland, notably south of Rietfontein. West of Aus, the line descends rapidly, and passes from sedimentary strata to the underlying granite and gneiss which form the surface rocks thence to the coast.

Below Aus, the hills, and later the sandy valleys and plains, become more and more barren until the desert-edge is reached. *Acacia Giraffæ* and even *A. horrida* are still represented in places where underground water would be expected to collect. *Ophioglossum vulgatum* was found widely spread in the sand, on which, as a result of heavy rains fourteen days earlier, many young seedlings gave promise of later luxuriance. The sudden appearance of seedlings a few days after rain is a remarkable characteristic of these dry regions. There can be no doubt that the seeds of annuals must in some cases retain their power of germinating through a series of years of drought, and the possession of this character is probably a determining factor in the persistence of many short-lived species. It is noteworthy that a considerable proportion of these belong to the family Leguminosæ in which species with long-lived seeds are numerous.* On the other hand, it should be remembered that outside the limits of the desert proper, a district which has been rainless for some time is usually not far removed from another in which the conditions have been less severe, and from which living seeds might easily

* Cf. F. F. Blackmann, *New Phytologist*, 1909, p. 31.

be conveyed by wind or some other agent. Although the vegetation in this locality was too young to allow of a thorough study of its composition, it was clear that many characteristic Kalahari species had crossed the watershed and were established under soil conditions almost identical with those that occur on the plateau.

The eastern edge of the desert is marked by what Schinz has described as a Euphorbia-steppe, of which constituents of minor importance are *Aloe dichotoma*, *Sarcocaulon sp.*, *Hermannia sp.*, *Zygophyllum sp.*, and *Acacia Giraffæ*, the latter represented only by a few dwarfed specimens. This zone is crossed near the station, Gorup, about 70 miles from the coast and 17 miles west of Aus, at an elevation of 2700 feet. The change from the karoid semi-desert in the neighbourhood of Aus to the true desert at a lower elevation seems to depend primarily upon the configuration of the land. The western edge of the plateau on which Aus is placed is high enough to precipitate rain from the sea winds. The clouds so formed do not extend westwards so far as Gorup, and the water which reaches this station is mainly in the form of surface drainage from the western slopes of the plateau. After a drought lasting several months, a violent thunderstorm broke in the vicinity of Aus on February 20, 1909. The sandy plain to the west of it was covered by a sheet of running water strong enough to make the railway unsafe, while sheets of rain fell as far as 11 miles west of Aus. But at Gorup, 3 miles further down, the sun shone unobscured all day and not a drop of rain fell.

The geological structure of the desert belt does not differ essentially from that of the higher country west of Aus. Gneissic and granite domes, peaks and ridges emerge from enormous accumulations of sand blown up from the lower-lying plains which are unprotected by vegetation. The flora of the desert is closely allied to that occurring on the western slopes of the plateau, though much poorer in species. These tend to decrease further west, and the poverty of the vegetation is nowhere more strongly marked than on the severely arid rocks and sand-dunes behind the town of Lüderitzbucht. Schinz has pointed out that the flora of the desert in Great Namaqualand, in the latitude of Lüderitzbucht, is poorer than that of Damaraland, north of the tropic. He believes that this difference is accounted for by the presence of a more copious supply of underground water in the northern area. While it is probable that this conclusion is well founded, there may also be other factors whose influence tends to increase the effects of the differences in subterranean humidity. According to Stewart,* the eastern limit of the belt in which at least 50 per cent. of the rainfall occurs in the winter months crosses the Orange river in longitude 17°·8, and probably emerges on the coast near the 25th parallel of

* C. M. Stewart, 'Science in South Africa,' p. 19. 1905.

latitude, *i.e.* a little south of the southern side of Walfish bay. If this is correct, such rain as the Namaqualand desert enjoys falls mainly in the winter, while the adjacent western edge of the plateau has a summer rainfall. It is quite conceivable that a smaller number of species derived from the plateau with a summer rainfall can become adapted to the conditions of a desert with an infinitesimal winter fall than to one in which, as in Damaraland, the little rain that does fall comes in the summer. There is also to be considered the fact that the Damaraland desert area meets in the north and east respectively the highlands of Ovamboland and Damaraland, possessing a richer flora than that of the Great Namaqualand plateau; it is thus able to draw its supplies from a wealthier source than is available farther south. In this connection it is significant that in the desert belt north of the Swakop, species of tropical affinity not found behind Lüderitzbucht constitute an important part of the flora.

The country between the Lüderitzbucht-Aus railway line and the lower course of the Orange river is a desert of the most severe type; it is uninhabited save for a few Bushmen and Hottentots, who are found chiefly on the northern bank of the river. Dr. C. Range.* Government geologist in Great Namaqualand, has penetrated this desolate region in certain directions from the east and north. He has made the most interesting discovery that *Welwitschia mirabilis* occurs in the southern part of Great Namaqualand, and is represented by a number of small plants as far as 31 km. south of Gorup. This locality, found quite by accident, is very difficult to locate and, owing to the total absence of surface water, still more difficult to reach. This observation extends the distribution of Welwitschia about 200 miles to the south of its previously recorded southern limit.† Dr. Range also confirms the statement of Th. Hahn, that the "Naras" (*Acanthosicyos horrida*) occurs on the sand-dunes near the mouth of the Orange river (see p. 485).

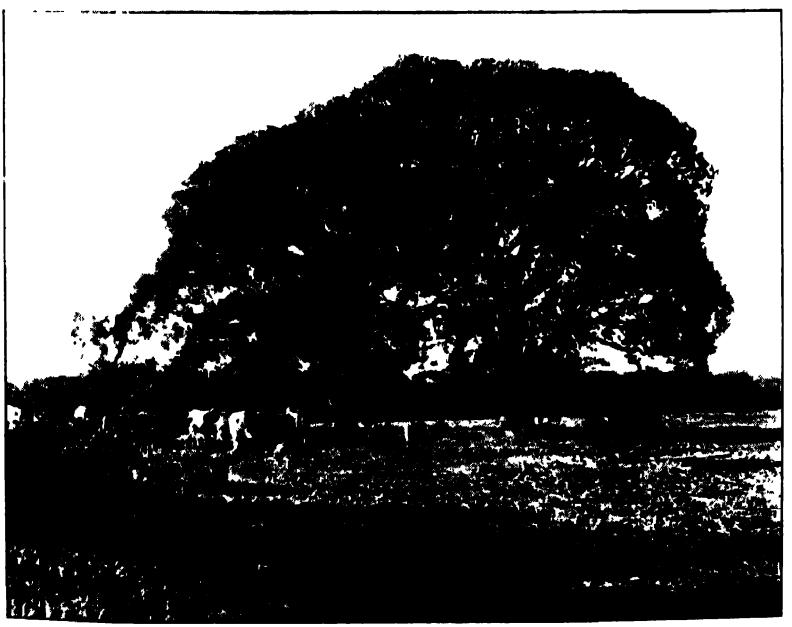
Between Rotkuppe (1000 ft.) and Lüderitzbucht, the mountain system is very complex; it bears so little vegetation that it produces an impression of extreme desolation. On the long wind-swept slopes of sand leading up to the mountain bases, plant-life is only represented by a species of Sarcocaulon with a bright yellow cuticle, thousands of which, leafless and without flower, present a remarkable appearance. Elsewhere, Euphorbia bushes are dotted over the surface. In the sand which collects in large dunes in the hollows on the hilltops, the vegetation is sometimes richer and includes grasses, *Pelargonium sp.*, *Pituranthos aphylla*, shrubby Asclepiads, and Mesembrianthema. It is

* I am indebted to Dr. Range for kindly permitting me to make use of this information.

† Pearson, Kew Bulletin, 1907, p. 347.



SOUTH ANGOLA. INSPANNING OXEN IN THE ACACIA FOREST BETWEEN GAMBOS AND TCHIPELONGU. THE DRY SEASON HAS COMMENCED (MAY, 1909), AND THE GRASSES ARE ALL DEAD.



SOUTH ANGOLA. AN "OUT-SPAN" BENEATH A LARGE FICUS IN AN OPEN GRASSY GLADE NEAR KIHITA.

a matter of common observation that the sea mists are denser and more enduring on the hilltops than lower down; consequently the conditions are there less unfavourable both for seed-germination and for root-absorption, and also the daily period of strong insolation is shorter than on the plains below.

Moving sand-dunes have occasioned very serious difficulties in railway construction in the lower part of the desert strip. The cultivation of sand-binding plants has been unsuccessful and, to prevent the advance of the sand across the railway line, various mechanical devices have been resorted to. Walls of stone and corrugated iron have been built across the direction of the prevailing winds and the windward slopes of many large dunes are carpeted with matting. In spite of all these, large bands of natives are continually employed in clearing the line. The wind, almost of daily occurrence, is very powerful, and it carries so much solid matter that it cannot be faced without considerable inconvenience. It carries to the hills enormous masses of the smaller granules from the lower slopes and plains, and leaves bare the fine worn gravels recently found to be diamondiferous. Diamonds are now being collected over a wide area extending south from Lüderitzbucht as far as the conveyance of food and water by camels and other means of transport is practicable. Lüderitzbucht itself is quite without fresh water. Five years ago, when what is now a busy port and a crowded township with a feverish stock exchange, was a desolate coast settlement with nine European houses, a fortnightly supply of drinking-water was brought by boat from Cape Town. Now the supply is obtained by the condensation of sea-water.

Swakopmund to Welwitsch. Feb. 27 *to Mar.* 12. *Littoral Desert.*—Damaraland was only penetrated as far as Welwitsch, a Welwitschia station 35 miles from the coast on the Swakopmund-Windhoek railway. The flora was in a much poorer condition than on a previous visit in 1907.* This is probably to be traced directly to the excessive rainfall which fell in December, 1906. The following is a summary of the meteorological records which were commenced at this station in November, 1906:—

1906.	November and December,	3 rainy days.	Rainfall, 12·5 mm.	
1907.	January to June,	5 „	„	0·5 „
—	July to December,	7 „	„	0·93 „
1908.	January to June,	4 „	„	0·12 „
—	July to December,	7 „	„	2·0 „
1909.	January and February,	7 „	„	3·9 „

Nightly, throughout the year, sea fogs envelop this locality with great regularity, and are not dissipated from the highest hills until the sun is well up. These are often sufficient to discolour the sand, and to

* Pearson, *loc. cit.*, p. 344.

make it distinctly moist to the touch. But without rain the deposit from fog is unable by itself to bring about the germination of the seeds of many annuals and the full vegetative and reproductive activity of many of the perennial species. It is further probable that a rain sufficiently heavy only occurs at long intervals; here again the seeds of many species must retain their vitality for periods of years under most unfavourable climatic conditions. The flora of this district has been briefly described in an earlier paper;* a further consideration is postponed until the collections of 1907 and of the present year have been studied in detail.

Mossamedes to Humpata. April 21 *to May* 4. *Littoral Desert, Vitis Zone, Open Bush and Forest, Savannah.*—From Benguella southwards, the littoral savannah which commences south of the mouth of the Congo is continued as a dry coast-belt in which the vegetation is very sparse. The desert itself commences at about lat. 14°·22 S.† Its rainfall is greater than that of the coast-belt of Damaraland, though irregular. Exceptional rains had fallen early in the summer of 1908–09, and the vegetation in April was unusually luxuriant. The plains behind Mossamedes were grass covered and the silvery awns of a tall Aristida, the most abundant species, glistened brightly in the sunshine. Many annuals belonging to the Ficoideæ, Compositæ, Gramineæ and other families flourished in the partial shade of the Aristida. The plain between Mossamedes and Cape Negro is the classical locality in which Welwitschia was discovered by Welwitsch in 1861. About 8 miles south of Mossamedes, the plants are met with in abundance and of much greater size than those in Damaraland. As in the latter locality, they are generally situated in dry water channels, and it may therefore be inferred that the seed distribution is effected first by wind and later by water. Most of this year's seeds were infertile, but very many young seedlings of earlier years were found. Compared with the plants seen in Damaraland the inflorescence stalks are very short and inflorescences consisting of a single cone are very common. The hollows of the stem were here nearly always filled with sand, and, in this, numerous plants of the tall Aristida were usually established. The Hemipteron *Odontopus sexpunctulatus* was even more numerous on and around the plants than in Damaraland; two specimens of this insect were seen in the town of Loanda. From the numbers and size of the Welwitschias in this locality and the frequency of seed-reproduction—the seedlings were certainly of several seasons—it is clear that under existing conditions the species is more at home here than farther south in Damaraland and Namaqualand.‡ Since no other members of the family occur south of the

* Pearson, Kew Bulletin, 1907.

† Monteiro, 'Angola and the River Congo.' London: 1875.

‡ See Pearson, *Nature*, 1909, p. 499.

Kunene and tropical species of other families are found far south of the tropic in Namaqualand, it may be inferred that Welwitschia is in its origin a tropical species and therefore more closely related to the tropical members of the family—now represented by the genus Gnetum—than to Ephedra. This conclusion is confirmed by a comparison of what is known of the life-histories of the three genera.

Mossamedes, the seat of the Governor of the district of that name, has about two hundred white inhabitants; the native population is almost entirely composed of "contracted" labourers, many of whom are sub-contracted to various householders as domestic servants. The most important export of Mossamedes is dried fish, a common article of food, both with the natives and the Portuguese, throughout those parts of Angola which are in regular communication with the coast. A small quantity of sugar, from the plantations in the bed of the Bero river, is also exported. Ivory and horns, with occasional consignments of rubber from the interior, have also been shipped in some quantity. But with the temporary cessation of railway construction and the prevailing unsettlement among the Boers of the Huilla plateau, these exports, as well as imports for consumption in the interior, have considerably fallen off.

The climate of Mossamedes is famous up and down the coast for its salubrity. Frequently a period of three or four years is rainless and, except for the night-fogs, the air is dry and invigorating. In exceptionally wet seasons there is stagnant water to the north of the town, and, as in this present year, fever is of common occurrence. That the town is usually healthy can only be ascribed to the powerful influence of the sun's rays in destroying disease germs; for its refuse is dumped down on the beach a few yards from the principal street, and measures to prevent the breeding of mosquitoes are neglected. Mossamedes could be made a valuable health resort in a country in which localities suitable for this purpose are few.

A railway from Mossamedes to Lubango, the capital of the Huilla province, situated at an elevation of 5460 feet, has been surveyed; 70 miles of it is already constructed (June 1909) and a daily service of one train a day each way is established as far as 66½ miles. The gauge of this line is 60 centimetres—the same as that of the German lines which connect the port of Swakopmund with Windhuk and with the Otavi copper mines. On leaving Mossamedes the line at first runs in a northerly direction, crossing the mouth of the Rio Bero half a mile from the town and, some five miles farther on, entering the bed of the Rio Giroual. Between these two river-beds there is a station at the north end of the bay, serving as a depôt for coal and other heavy cargoes—the facilities for landing being greater here than in Mossamedes itself. Near its mouth, the bed of the river Bero is a mile or more from bank to bank. During exceptionally rainy seasons

it contains a good deal of surface water in which mosquitoes breed freely. At such times malaria is common in Mossamedes. Both here and in the bed of the river Giraul there are many Faciendas in which sugar cane and other tropical and sub-tropical crops are cultivated. As soon as the railway leaves the bed of the latter, it enters, at about 410 feet, upon a plain which is without surface water as far as the position of the present railhead—except in places where rain and dew collect, as in the hollow of the remarkable mass of granite known as "Pedra Grande."* At about 37 miles from Mossamedes there first becomes visible, at a distance of some 62 miles, the perpendicular front of the Shella range, whose summit is between 3000 and 4000 feet above the plain on which it stands. At about 27 miles from the sea, and 1100 feet above it, there commences a zone in which the predominant plant is *Vitis macropus*.† Above this zone the vegetation changes rapidly; grasses increase in number and soon cover the surface thickly; bushes of Acacias, *Bauhinia garipensis*, Acanthaceæ, etc., occur with increasing frequency; before the railhead is reached, shrubs and small trees are the most conspicuous elements of the vegetation.

Transport from the present railhead to the plateau is difficult and slow. The waggon-road is circuitous and exceedingly rough, and its passage from the railway terminus to the Boer settlement of Humpata (6100 feet) occupies seven days. There is, however, an alternative and more direct route, inaccessible to waggons, which may be traversed on foot, on horseback, or in a "tipoia," in three days or less. This road ascends gradually for 25 or 30 miles, at the end of which we are 3300 feet above sea-level and at the foot of the Shella range. Here the path enters a most picturesque pass, which gives access to the Huilla plateau. A few miles from the foot of the pass is the fort of Kapangombe, erected about 1860, now practically abandoned. Near it is the store, kept by a half-caste Portuguese, now probably even more deficient in goods than when it was visited by the Earl of Mayo in 1882.‡ It is situated in an open forest dominated by the "Mutiati" tree, *Copaifera Mopane*, whose fibrous bark provides the native with a most efficient substitute for rope and string, and the Baobab (*Adansonia digatata*). In the neighbourhood are a number of Faciendas largely devoted to the cultivation of cotton.

From this point there is obtained a fine view of the perpendicular edges of the beds of sandstone which form the upper part of the range. Along the skyline appears dense vegetation, but the precipitous face seen from this distance is bare and grey. The outcropping strata are

* See Monteiro, *l.c.*, vol. 2, pp. 221, 222. Monteiro here gives a general account of the geology of the coast-belt along this route.

† See p. 485.

‡ Proceedings of the Royal Geographical Society, vol. 5 (1883), p. 458

horizontal, and from this point of view the Shella range is extraordinarily like the front of Table mountain as seen from Table bay, but on a much larger scale. From September to April the top of the range is very generally enveloped in cloud, and thunderstorms are of frequent occurrence in its neighbourhood, particularly towards evening. By the beginning of May the rains have usually ceased. On entering the kloof, the path runs through fairly dense forest, in which giant Baobabs, now losing their leaves, are the predominant constituents. Above the forest, on either side, is a perpendicular wall of rock, perhaps 2000 feet high, on the face of which a few scattered shrubs retain apparently precarious footholds. As illuminated by the setting sun, the rock-face is no longer grey, but presents a gorgeous combination of orange, yellow, pale green and dull blue shades, indicating a rich growth of lichens. The path is rough, but shaded by the walls of vegetation which bound it. Here it runs alongside a coffee-plantation with heavily laden orange trees; farther on it follows the course of a mountain torrent, and is lined by rich masses of maidenhair and other ferns; near the top the grasses increase in number, and there are encountered gnarled trees and low bushes of Proteaceæ constituting the most striking elements of the flora of the savannah which occupies the main extent of the plateau. The magnificent view of the plains to the west which is obtained from the top of this pass has excited the admiration of every traveller who has ascended it.*

Humpata (6100 feet) is situated about 12 miles from the summit of the pass, in a north-easterly direction. The climate of the plateau is, for the white man, one of the finest in Tropical Africa. The winter season is dry, with bright sunny days and cold nights in which the temperature commonly falls below the freezing-point. A sufficient supply of good water is available all the year round and mosquitoes and fever are absent. Humpata and Lubango are important headquarters of the small Boer community which has been settled on the plateau since 1881.† Lubango is also the seat of administration, and the residence of the Governor of the Huilla district which extends across the Kunene to the German frontier. The Boers, who at the present time are estimated to number about one thousand, have been engaged mainly in hunting and cattle-breeding—cattle having been largely employed in transport to and from the coast and the interior. A little cereal cultivation (principally wheat) has also been carried on, but agriculture in general has received little attention. Various circumstances have caused some degree of dissatisfaction with Portuguese rule, and this, with the retreat of the game and the decline in the demand for ox-waggon transport—which will become more marked

* Cf. Earl of Mayo, *loc. cit.*

† Pearson, 'The Boer Colony in Angola,' *Morning Post*, December 25, 1909.

as the railway construction proceeds—have led many of them to desire to return to the home of their fathers in the Transvaal. The exodus, by sea, has already commenced and is likely to continue until a considerable proportion of the colonists have become repatriated. This will not be without its effect upon the Portuguese administration, for the Boers have, directly and indirectly, done a great deal to quell the native opposition to the extension of an effective Portuguese occupation down to and beyond the Kunene. When their influence is diminished or removed entirely, the difficulties of maintaining an effective control throughout the district will be greater than they have been in the past.

Humpata to Fort Rosadas, May 10 *to May* 21. *Savannah, Open Forest, Marsh.*—As a consequence of a series of military operations which have been in progress recently against the Ovambo tribes north of the German border, there are at present well-beaten tracks from the plateau down to the Kunene, following for the most part the course of the Kakulovar, which joins the Kunene a little below the position of Fort Rosadas. This route is now well known, and its general features have been described by the Earl of Mayo,* Baum † and other writers; its flora, however, which appears to be very rich, has been but little exploited. The whole region has a summer rainfall, which is frequently heavy and, on the lower ground bordering the Kunene, causes extensive floods. The rains normally cease early in April, and in the winter season, which is rainless, the ground becomes dry and hard as iron. In the summer there is much fever below 4500 feet, and this of a somewhat virulent type. Sleeping sickness is not known so far south. After the rains have ceased, the water-supply becomes scarce and all that is available between Gambos and the Kunene is usually more or less discoloured and fetid, and, even after filtering and boiling, cannot always be drunk with impunity. The open Proteaceous forest of low trees and bushes with an undergrowth mainly of grasses descends as far as Shibia; below this it gives place to an open forest in which the leguminous *Copaifera Mopane*, the Baobab, and various Acacias in turn predominate. A few species of Ficus, mostly tall and handsome trees, are present. Two palms become fairly common in the more open country near the Kunene. Epiphytes and lianas are rather rare, though the latter perhaps occur somewhat more frequently than would be expected from the open character of the forest and the length of the dry season. Many of the trees are deciduous; of these the Baobab, which is well known to be a light-loving tree, is practically confined to open glades, in which it spreads its huge leaf-bearing branches above the level of the surrounding forest. The undergrowth during the wet season is mainly composed of a dense growth of grasses, among which the genus Aristida

* Cf. Earl of Mayo, *loc. cit.*

† H. Baum, 'Kunene-Zambesi Expedition.' Berlin: 1903.

is conspicuous; these die down as the dry season advances. Next in importance to these are small gay-flowered bushes of the family Acanthaceæ and numerous small Leguminosæ (among which the genera Indigofera and Dichilus are important), mostly prostrate or climbing. Within recent years lions and other large game have almost disappeared, and animal life is no longer conspicuously abundant. Crocodiles are abundant in the Kaculovar and the Kunene; guinea-fowls, apparently of two species, are met with in large flocks, and at sunrise the forest resounds with their cries. Snakes are rarely seen, but scorpions abound in the hot sand of the dry river-beds.

Except in the immediate vicinity of the mission stations, few natives are seen along the transport roads, though fields of millet—the most important native crop—and recently abandoned clearings show that inhabitants are in the neighbourhood or have recently left it. Their absence from the vicinity of the road is no doubt due, in some part, to the demands made upon them for food and other commodities by an impoverished and disorderly soldiery on their way to the front, and to their dislike for compulsory service as labourers or carriers, which is still enforced very much as it was in 1854, when it was described in the Golungo Alto District by Livingstone. The Gambos natives (west of the Kunene) are a simple people, shy, but easy to deal with when they are properly treated. Many of them show a distinctly Egyptian cast of countenance. They are small of stature, and both men and women present the appearances of advanced age while they are yet young in years. The dress, both of men and women, consists of a short petticoat depending from a waistband. European clothes are eagerly adopted as opportunity arises. Charms or fetishes of various kinds are suspended from a leather thong round the neck; in the case of natives under the influence of the missions, an iron cross finds a place among them. Usually a necklace of large coloured beads is also worn. Men and married women adopt a remarkable style of hairdressing. The hair is incorporated in a thick mass having the consistency of fresh putty; this substance is composed of clay, ox-fat, an oil obtained from a seed (said to be that of *Ximenia americana*) and a red vegetable colouring matter ("mumbiri"). The form of the mass varies considerably, being usually more complex in the case of the women. But whatever its form it always projects over the back of the neck, and so undoubtedly affords some protection against the rays of the sun.

The French Catholic Mission of the Order of "*Le Sacré Cœur*" has established mission stations along the route at Huilla, Shivinguiro, Kihita, Gambos, and Shipelongo. An extension to the south-east among the trans-Kunene Ovambo tribes is contemplated. Each mission station is surrounded by a native settlement. At Huilla, the principal station, there is a large industrial establishment attached to the mission, in which about eighty natives are employed in various skilled trades—

tanning, boot-making, tailoring, carpentering, masonry, iron-working and printing; waggon-building and repairing, for the Boers on the plateau, is an important branch of its work. A steam engine—of the portable type ordinarily used in agricultural operations—has been brought over the plateau from Mossamedes by native carriers and set up on the premises; it is employed in cutting wood, breaking up the bark used in tanning (*Berlinia sp.*), grinding corn, and in lathe work. There is a large garden well stocked with European vegetables and fruit-trees; a section is devoted to the experimental cultivation of exotic trees and of native plants reputed to be of use for medicinal and other purposes. The upper part of a small observatory is devoted to meteorological work; in its lower storey there is a collection forming the nucleus of a museum illustrating the zoology of the district. The names of Fathers Antunes and Dekindt are associated with important botanical investigations on the Huilla slopes; these are being continued by the present Father Superior.

Apart from the missionaries and the garrisons of the forts, there are few white settlers between Shibia and Humbe. These are engaged in cattle-breeding and transport-riding. Between Ediva and Humbe an extensive experimental cultivation of cotton was commenced two years ago by an Anglo-French company.* It is yet too early to judge of the quantity and quality of the yield, or whether any profits will be left after the cost of the long transport to the coast and the heavy export dues are paid; but it is encouraging that those immediately interested are confident of success. If this is achieved, cotton cultivation will be capable of great development on both sides of the Shella range.

Humbe is situated on the low ridge dividing the valley of the main stream of the Kunene from that of its tributary, the Kakulovar. On crossing the latter from the west, the forest becomes more open, and the approach to Humbe lies through a scrub of low Acacia bushes. Beyond the village, consisting of a fort, a magistrate's office, a store and a few huts, the country is open. The most striking plants are a giant Euphorbia (20 feet high), a Ficus, the Baobab, and an acaulescent palm (*Hyphæne sp.*). The bank of the Kunene, opposite Fort Rosadas, is about 6 miles east of the Humbe ridge. In the dry season waggons traverse the whole distance without difficulty, but before the summer floods have subsided a belt of lowlying land on the west side of the river, from 1 to 2 miles wide, is submerged and must be crossed in boats. At the end of May of this year the water was still too deep for waggons and yet too shallow for boats. It was therefore necessary to wade through a marsh infested with crocodiles for a distance nearly as much as a mile in order to reach the river itself. Thick beds of

* Pearson, *Gardeners' Chronicle*, 1909, p. 415.

reeds cover extensive areas of the marsh; an Azolla, a Marsilia and a particularly fine species of Utricularia were found in the more open pools, though the season for aquatic plants was almost passed. Isolated trees (*Ficus sp.*, etc.) occur on the higher ground away from the river.

The current of the Kunene, about 100 yards from bank to bank, was very strong; the crossing was effected in a small, flat-bottomed iron boat whose accommodation is insufficient to cope successfully with the heavy transport, military and civil, which reaches the river at this point. Oxen are made to swim over, a gun being fired at each crossing to scare away the crocodiles. Fort Rosadas, on the opposite bank, has a commanding position on a high chalk cliff overhanging the river. Until recently it has been the frontier fort; as such it has witnessed many hard-fought engagements between the Portuguese and the warlike Ovambo tribes who occupy the country to the south. The vicinity of the fort is extremely unhealthy—a condition largely due to the utter neglect of the most elementary sanitary precautions. That no improvement in these matters had yet been effected was proved by the presence of the decomposing body of an ox and other organic refuse within a short distance of the walls of the fort. The mortality among white troops stationed there has been so great that it will in future be occupied only by native soldiers.

The forest flora of Gambos and Humbe recommences a mile or two from the left bank of the river. This region, as far as Humbe, has been traversed by Schinz* in the course of his journey northwards from Great Namaqualand. He states that *Copaifera Mopane* has its southern limit at about 20° S. lat., and that other important elements of the flora extend further to the south-east into Ngamiland; to the south and south-west, however, many of these give place to species of Acacia, the dominant trees and shrubs throughout the highlands of southern Ovamboland and Damaraland.

The PRESIDENT (before the paper): The lecturer to-night, Dr. Pearson, has every right to speak on botanical subjects with authority. He is Professor of Botany at the African College at the Cape, and is in charge of their herbarium. After taking an excellent degree at Cambridge, he went as travelling student to Ceylon, and on his return from his journeys, he was appointed Chief Assistant at the Royal Gardens at Kew. He has, I think, made three journeys in those parts of Africa about which he is going to speak to-night, mainly with a view of searching for the welwitschia, an exceedingly interesting plant. But although he has perhaps been interested in questions connected with the geographical distribution of plants, I feel quite sure that before this lecture is over you will agree with me that he has always kept his eyes open for all other geographical questions, and that we shall hear a great deal of interest about these desolate and interesting countries.

Sir SOMERSET FRENCH: I am sure we have all listened with the greatest

* Schinz, *loc. cit.*

interest and pleasure to the lecture which has been delivered by Prof. Pearson. I cannot claim to have had any personal experience of the parts of South Africa about which he has been speaking, as they are far distant from those portions of the Cape Colony which are generally visited by travellers and others, but I hope that no one here to-night will form the impression that Bushman Land is in any way typical of South Africa as a whole. It is certainly very interesting from a botanical point of view on account of the peculiar vegetation which is found there, and which differs, as we have heard, in many respects from the prevailing types in other parts of South Africa.

It will perhaps interest you to know that, owing to the sandy nature of the soil and the desert-like character of the country generally, the Cape Colony Government some years ago decided to introduce camels for police and transport purposes. You will hardly be surprised at this, after hearing from Dr. Pearson that the water-pools upon which human and animal life is dependent are generally about 60 miles apart. At several places along the border of German South-West Africa the police-patrols, who, we have been told, generally consider a messenger a safer means of conveying important intelligence than the heliograph, are mounted on camels; and the post which runs between Zwart-Modder and Rietfontein on the German border is also conveyed by means of these animals.

There are other points of interest which I might dwell upon, but unfortunately, not anticipating that I should be called upon to speak this evening, I did not bring any notes with me. I think, therefore, I had better make way for some other speaker who is in a better position than I am to continue the discussion.

Dr. O. Stapf: I have followed with much interest Prof. Pearson's account of his journey, which will, no doubt, form a very valuable contribution to the physical geography of South-West Africa. I am saying this not only under the impression of what we have heard from him, but also from my knowledge of his collections, which are at Kew, where they will be worked out. It is, of course, quite impossible to deal here in detail with the many questions which arise in connection with his paper, but I should like to make a few general observations. We have gradually come to the conclusion that, speaking very broadly, the flora of South Africa, with the exclusion of the extreme South-West, but including the Cunene and Zambesi basins, and that of East Africa, exhibit sufficient affinities to justify us in treating them as one great phytogeographical province, the East and South African Steppe Province, as Engler has termed it. What Prof. Pearson has told us agrees well with this great generalization. On the other hand, considerable uncertainty exists as to the exact character and extent of the subdivisions of this area, and it is in regard to these that I expect most from his collections and observations. To mention only one example, I would point to his account of the existence of the "Composite" flora—I hope he will find a less inconvenient term for that flora—on the mountains of Great Namaqua Land. We should, no doubt, have been able more or less accurately to deduct that and similar facts from his collections by tabulation. But how wearisome is not this process, and how bare the result, compared with the observations made on the spot by a well-trained field-worker like the lecturer, who takes the facts in with a glance, and at the same time sees them in their full natural setting? In saying this, I do not wish to speak disparagingly of the laboratorium and herbarium work at home, work which after all supplies the field-worker with the necessary means for correctly analyzing and co-ordinating his observations. But if Prof. Pearson's success is to a great extent due to his previous training in the laboratorium and herbarium, it stands to reason to wish that the laboratory and herbarium man should have his share of training in the field before he finally settles down to home work, which otherwise is apt to become narrow and

try. In accepting Prof. Pearson's paper, which contains so much botanical matter, your Society may seem to have gone somewhat out of its way. If this should be so, we botanists, at any rate, have reason to hail the occasion as proof of the recognition on your side of the importance which attaches to plant-geography in its relations to the problems of physical geography.

The PRESIDENT: When you see Dr. Pearson's paper in our *Journal*, you will find that it contains a vast amount of information about the flora of this region, and that it certainly is a paper which must be consulted by any one who wishes to study the geographical distribution of plants in this part of Africa. I think he has been wise to-night in giving us a general description of the country, whilst merely introducing the botanical element to the extent that the non-botanical mind can follow. I must confess that the remark which will remain longest in my mind is one which Prof. Pearson made to me before the lecture. I do not pretend to repeat it exactly in his words. We were talking of golf, and he said that this country is the worst in the world for putting greens and the best country in the world for bunkers. It would be difficult in as few words to give a more accurate description. Seriously, Dr. Pearson has given us an extraordinarily vivid picture of this arid region, and I am sure you will wish me to thank him most heartily for his most interesting lecture.

Prof. PEARSON: I have to thank you very much for your kindness. I should like to say that the expedition which I have had the honour of saying something about to-night was carried out under the auspices of the Percy Sladen Trustees and the Government Grant Committee of the Royal Society.

EXPLORATIONS IN BOLIVIA.*

By Major P. H. FAWCETT, R.A. (retired).

FROM time to time short accounts of the explorations and boundary work with which I have been associated in South America have been contributed to the *Journal* of this Society, whetting the appetite, perhaps, of those interested in such work for more information regarding this neglected continent.

In this particular paper I have endeavoured to embody in a very limited space three objects: firstly, a general idea of Bolivia as it is to-day, apart from political questions and existing commercial conditions which can be found elsewhere; secondly, an insight into the nature of exploration in the uncivilized regions of this little-known continent; thirdly, a short personal account assisted by lantern slides of the explorations which I have conducted on the borders of Bolivia and Brazil, together with the results that have been achieved.

Bolivia is the Switzerland of South America, cut off from the sea, and lying roughly between 10° and 23° S. lat. and 57° and 73° W. long. It possesses an area of something over 650,000 square miles, or over five times that of the United Kingdom. Speaking generally, it can be divided into four zones: the Altiplanicie, or high plateau west of the main Cordilleras, 11,000 to 14,000 above sea-level; the Cordilleras,

* Royal Geographical Society, March 14, 1910. Map, p. 620.

or deep mass of snow-capped Andes, whose main peaks have attracted considerable attention of late years; the sub-tropical abrupt eastern slopes; and the more or less tropical plains which form portion of the basin of the interior South American water-system.

West of the Cordilleras the country is practically bare of vegetation, except where cultivated in the neighbourhood of the great lakes and in the valleys of the Andean rivers. East of the Cordilleras is a region of forest and vast campos or grass plains. With the exception of a few unimportant streams which empty themselves into the great lakes of Titicaca and Poopoo, all the rivers flow from or through the Cordilleras into the basins of the Amazon or Paraguay.

Bolivia is exceedingly rich in natural resources, and is progressing with that remarkable rapidity which seems to have overtaken the southern republics of the continent during the past decade. It is handicapped by its small population of under two millions, of which one half is Indian, one quarter mestizo or mixed, one eighth white, and the rest nondescript. The census is not very reliable. This population is centred upon the Altiplanicie and in the towns and villages of the south centre; the remainder is distributed thinly along the banks of the principal rivers and upon the scattered fincas of the Cordilleras. As behoves the descendants of the Spanish conquerors and the old Incan empire, the race is strong, virile, and intelligent.

Indian ethnological details are most complex. West of the Cordilleras are the Quichuas and Aymaras, descendants of the Incan empire; east an infinity of small tribes distinct in feature, language, and customs. Hovering on the confines of civilization are the savages, debased and intelligent, dwarfs and well developed, usually cannibals, and preserving a revengeful hostility against everybody outside their own tribe. In the heart of the continent they are beyond the pale of communication, and their origin is shrouded by that veil of conjecture behind which lies all Indian history prior to the last Incan dynasty. Many explorers and expeditions have entered their forests, yet practically nothing is known of their customs. The tale of tragedies and lost expeditions is a very long one, for they are treacherous and merciless to those whom they consider their hereditary foes.

Communication within the republic is improving yearly by the extension of railways. La Paz is in railway communication with Antofagasta in Chili and Mollendo in Peru. A railway from Arica to La Paz is under construction. Branches are being pushed out to Cochabamba and Potosi; and other projects, including a transandine line, are under consideration, and will be carried into effect within a few years. La Paz thus becomes the pivot of the Bolivian railway system, which ensures it being the centre of all future development. It is expanding by leaps and bounds. Fine buildings are springing up; the city is extending down the valley; it is electrically lighted; and

there is a good tram service. Broad-minded legislation and municipal enterprise will, in the near future, make it the Garden City of the Southern Pacific—a Mecca of the Andes for tourists who can appreciate the grandeur of mountain scenery and the historic romance in which these highlands are steeped. It has a dry, invigorating climate, and sanitary improvements are proceeding apace. Fairly good roads connect all the larger towns. Across the passes of the Cordilleras are mule-tracks following the long hog-backed ridges which extend like the tentacles of an octopus into the eastern forests. East of the Cordilleras communication is usually by water, as soon as the mountain torrents settle down into reasonably safe navigability. Beyond these waterways, and excepting amongst the group of rubber properties which patch the north-eastern and eastern frontier regions, is virgin forest. There is no portion of the country from north to south and east to west which, with an assured market, can be reckoned undesirable for the immigrant. Much of it is mineralogically and agriculturally a paradise.

The climate, except on the extreme frontier, is not unsuitable for a white man. Everything grows luxuriantly. On the great grass plains which lie inside the belts of rich forest bordering the rivers, there is ample scope for cattle-raising. There is practically an unlimited field for the prospector; and the rifle can be relied upon for food within the limits of the Amazonian forest. There are Englishmen and other foreigners dotted about the eastern slopes of the Andes to-day leading a profitable Arcadian existence free from anxieties and taxation of any kind. For the lucrative exercise of skilled craftsmanship there is splendid opportunity for the man who does not drink and will learn the language.

Now, the interior of South America is largely unmapped, or incorrectly mapped, and in vast areas still unexplored. All the main rivers have been traced for the greater part of their courses, and certainly all those easily navigated. But outside of that area on the principal rivers of the interior occupied by rubber exploitation absolutely nothing is known of the country a hundred yards from the river-banks. When that intrepid explorer, Chandless, ascended the principal tributaries of the Amazon in a canoe with only three or four peons, in the sixties to be more precise, the wild Indians were not so markedly hostile as they are to-day. Indeed, he was usually well received and fed. Since that time the savage has been sacrificed to rubber; slaughtered often under circumstances of horrible barbarity; his villages burnt and his farms destroyed; either to secure forced labour for the rubber estates, or to exterminate him from the field of its exploitation. These methods have long ceased to receive official encouragement. But to-day a perpetual war of reprisals is being waged between civilized and savage; and this revengeful hostility constitutes one of the greatest dangers of South American exploration. It is more

than doubtful if the really wild Indians of South America are amenable to civilization as understood by those with whom they come into contact. The time will come when they must have their recognized reserves or disappear.

Regarding the natural resources of Bolivia, one hesitates to court a suspicion of exaggeration. I have no personal doubt that it is a commercial Eldorado of the future. On the Altiplanicie there are coal and copper, and much undeveloped tin and silver. The high plateau itself is remarkably fertile, and only lacks irrigation. There is no reason why the fine wool industry should not be considerably extended and organized. The main cordilleras are one huge minefield awaiting cheap transport for freer development. They have only been picked at here and there. Gold, silver, tin, copper, bismuth, and precious stones have been extracted from them, with very superficial prospecting. Across the mountains are the fertile valleys of the Yungas, Challana, and many more, well watered and well wooded—almost every stream giving colours to the gold prospector. There is the virgin region of the Caupolican, almost of a certainty rich in minerals.

Bordering the valleys to the east are grass plains, which only lack easy communication for an extensive cattle industry—also the region of coal and petroleum, both in quantity. On the Altiplanicie and Pacific coast generally there are constantly increasing demands for food, fuel, and building materials, all lying in abundance a few miles over the mountains, and at present imported. Rubber in the higher lands east of the Andes is not a commercially good enterprise, except with abnormal prices, for the trees are comparatively few and give little latex.

The forests which extend from the Andes to the Atlantic abound in valuable timber, walnut, cedar and hard woods, and the soil is prolific. In the basin of the Amazon, from about 800 feet above the sea down, rubber is exceedingly rich. In places one man can gather two tons a year. Caouchouc is plentiful up to 1500 feet. The Peruvians concern themselves with this product, the extraction of which involves the destruction of the trees.

The duration of the rubber industry in Brazil and Bolivia is a matter of great interest and diversity of opinion. The areas most prolific in rubber trees are already exploited, but there are yet vast untouched areas where the trees are not so numerous or generous of latex. In certain places reckless gathering has destroyed the trees. In others, possibly owing to the seed falling from trees which have been assiduously tapped, the young trees are weak, and either fall a ready prey to insects or, reaching a growth of some 6 feet, wither away. There is very little planting attempted.

To the south and west of the rubber districts lie the great plains of Mojos rich in iron ore. Over these plains still range herds of wild

cattle. So savage are they that to traverse the plains on foot is a most perilous matter.

With the headwaters of the Guapore and its tributaries terminate the Amazonian forests. The schist, granite, and sandstone masses of the Ricardo Franco, Parecis, and Aguapeh hills form the watershed of the Amazonian and Paraguayan basins. To the south stretch the flat plains of the Paraguay, punctuated by short ridges and conical hills of limestone and ironstone rich in manganese—a patchwork of scrub, forest, swamp, and grass plains. From here south, where the annual inundations permit, the country is occupied by small squatters trading in the Paraguay, with a commercial centre at Corumba. Near the old city of Matto Grosso the scrub forests, rich in cotton trees, clothe themselves in wonderful beauty in the early spring; a few bright greens and elegant palms, and for the rest a riot of flowers, blue, yellow, purple, and red—gorgeous and prodigious natural bouquets.

Corumba is a centre of considerable trade. I have heard the Paraguay river termed a disappointing waterway. Yet between Buenos Aires and Corumba there is all the year round navigation for steamers drawing 7 feet of water, and from December to June considerably more. Between Corumba, Cuyaba, and St. Luiz de Caceres there is always navigation for launches drawing 3 feet. Corumba is being linked to the Atlantic by railway, which will do much for this region, as also Eastern Bolivia. The section from the Parana to Miranda will be completed this year.

For Bolivia the great difficulty is its scanty population, and its inability hitherto to attract immigration. So much so is this the case that in the north-eastern regions east of the Cordilleras riches are measured by the number of men at the command of an individual. A man with fifty peons is a capitalist. The greatest rubber concern in the Beni, with three thousand peons, is practically a state. So much for the general features of the country.

There is talk of more attention to South American exploration, and as, even in the continent itself, it is extremely difficult to obtain any reliable idea of the conditions it is necessary to contend with—chiefly perhaps because explorers outside more or less civilized regions do not exist—I am going to give a short impression.

The upper waters of the Andean rivers are mountain torrents which cut a roaring and resistless passage through their valleys of slate, gneiss, and sandstone. If the long tiring mule journeys to the south are to be avoided, it is necessary to descend these torrents on a raft, called a "callapo," managed by five or six Indians. It is sufficiently perilous to please any one. When the rivers become clear of rapids, navigation is continued in open boats of an awkward model, known as "batelones," paddled by a dozen to twenty Indians or mestizos. In the area of rubber estates there are river launches.

The currents of these rivers vary from 3 to 6 miles an hour, and their courses are obstructed by snags so numerous as to be a constant menace to navigation. The result is frequent shipwreck. Now, once wrecked there are other unpleasant possibilities besides getting wet. In the Amazonian rivers there are anacondas, crocodiles, electric eels, sting rays, and the perania, a small deep-bodied fish with razor-like teeth and an unappeasable appetite for blood. This last is more numerous in the river Paraguay, where men who are unfortunate enough to fall into the river may be picked clean before they can be rescued.

In the river Paraguay and its tributaries is also to be found the "mungruyu," locally known as the fresh-water shark, probably a variety of the Brazilian arapaima, and reputed to consider any luckless human being as an article of diet.

The consequence of these presences is a high percentage of mortality, notwithstanding that the Indian is a splendid swimmer. Men bathing not infrequently disappear. When I was returning from Riberalta to La Paz *viâ* the Beni at the end of 1907, we were wrecked three times—once on a sandbank where the boat turned turtle, and twice on snags. The second time I had an Indian seated upon a hole about the size of his head for two hours to keep the boat from foundering. One perforce gets accustomed to such accidents after a time, and trusts that they will occur in convenient places. It is said in the lower Beni that 25 per cent. of the crews of the river boats perish annually of accidents and fever. The food question is a serious one. Starvation has been the great difficulty in South American exploration from the days of Pizarro, whenever any considerable force has been employed.

Rubber baraccas and small estancias exist at intervals on the main rivers, where rice and chaki or dried meat are obtainable; and at a centre, for instance, like Riberalta a few preserves can be purchased at a price 1000 per cent. over those familiar outside. Game is nowhere plentiful in South America. There is usually sufficient to feed a small party, but never a large one. But it is rarely advisable to separate a party in order to hunt for game, owing to the savages and the danger of getting bushed. About six years ago a French firm in the Beni sent an expedition of twenty-three men into the upper Madre de Dios to look for rubber. Of the party only three returned, the remainder died of starvation or its effects.

The jaguar is common enough, particularly in cattle districts. He is usually cowardly, but in places is a man-eater. There are two varieties, one the size of a big leopard, the other somewhat larger than a Bengal tiger. In the cattle districts of Mojos and the Paraguay, it is a common sport amongst the Gauchos to lasso these beasts. The black panther is, however, universally dreaded. He is rare, and I have only seen one skin. The anaconda is ubiquitous, and haunts rivers, swamps, and lagoons. It moves by night, and has a weird cry. The rattlesnake,



SORATA



LA PAZ



COBIJA OR BAHIA



VIEW FROM COBIJA, RIVER ACRE

or cascabella, and other species of poisonous snakes are about as abundant as such reptiles are in India, but are rarely met with in the dry season.

Insects are legion. They are the pest of South American travel. Mosquitoes of course; roca-roca, a microscopic fly which at times makes observation work by night almost impossible; marigwis, or the Portuguese pium, which in the dry season attacks in thousands, every one leaving its small blood-blister; "gehene," a microscopic night fly which penetrates any mosquito net; tavenas, or a species of poisonous housefly; wasps and bees of all sizes. Bees do not suggest any serious discomfort. Yet in places one is covered from head to foot by them, inside one's clothes and outside, in one's ears, nose, eyes, hair, and mouth if it is opened, pungent odoured and seeking salt perspiration. Feeding by day under such circumstances is out of the question. If I could describe the misery born sometimes of these flying and crawling pests, it would be thought a traveller's tale. There is only one remedy—custom. There are moths and flies which lay eggs in the head or under the skin, ripening painfully to maggots. There are jiggers for the toes; ticks in myriads; guanacos, a small white insect something like a tick, only with an infinitely more irritating bite; microscopic ticks, known as the "haputama," or "bichu colorado," which burrow and die under the skin; venomous giant spiders, known as "apazancas;" vampire bats and ants.

The latter are a perpetual worry in the forest. The worst are the small red species which colonize the "palos santos," or sacred trees, and whose bite is worse than a wasp-sting. The savages have an unpleasant custom of binding captives to these trees, which involves a painful death in about two hours. There are the tucandera, or black ants, about an inch in length, which live six or seven together in trees. Their bite is agonizing. Mr. Fisher, my assistant since 1908, was a victim. In Indians or South Americans it usually induces a high fever. One can almost generalize and say that every insect bites or stings or annoys in some manner. There is a species of ant with formidable mandibles known as the "sepi," which attacks by night. I was reduced to rags by an experience of this sort in the Verde.

I do not mean to suggest that this tale of insects is to be found everywhere. It is in any case confined for the greater part to the forest regions and plains under 1000 feet above sea-level. Moreover, they have their seasons and localities of special activity. Mosquitoes are ubiquitous, and worse in the rivers than in the forest. They are particularly voracious in the wet season. There is a white variety in Lake Caceres, near Corumba, which are most venomous, and in the Acre a mammoth about an inch in length about whose character local rumour has been busy. The "pium" is at its worst in the Orton and Madre de Dios; ticks and "guanacos" in northern Matto Grosso in the dry season. The "Palos santos" ant haunts the margin of rivers, and

is most active in the Abuna, where small areas of forest are to be found consisting wholly of these trees impassable alike by man and beast. The "tucandera" and "sepi" prefer dry country. Bees favour dry cotton-wood forest, such as in northern Matto Grosso, where rotten trees and plentiful flowers suit their peculiar needs. "Tavenas" and wasps are more active in the Acre. Insect life is, however, a curse to low-country exploration. One is scratching or slapping every waking moment.

In villages and baraccas palliation can be obtained by clearing and cleanliness; and the "pium" will not enter a darkened house. Scratching is commonly reputed to be the cause of "espundia," a very common ulcerous sore most difficult to heal; and the virus of this sore may be carried to the nose, in which case the cartilage sloughs away. All the fevers to which the tropics are heir may be met in the forest, and other grievous disorders more or less obscure, such as beri-beri, espundia, and "corupcion." Most of these are fortunately confined to areas of population, where they are encouraged by bad food and complete absence of sanitation. Imagine chaki from which the maggots have to be shaken, and rice which has to be washed again and again before it is fit to eat. Yet in the rubber zone, where communication is precarious and there is practically no game, one may be glad to get even this. Fortunately, except in the towns of the higher country, typhoid and dysentery are unknown.

The vegetation of the forest itself needs care. The Brazil nut tree, prolific in the Amazonas, sheds its heavy nuts in December and January from a height of 100 to 150 feet. Broken heads and bones are not uncommon. There is, too, a species of tree met with in the poorer forest on the higher ground near the sources of rivers, paralleled, I am told, in Central America. A colourless liquid drops from its leaves, which causes the body to swell, accompanied by great pain. Clothes, doubtless, are a protection. I had an Indian peon so affected in the Verde, who was familiar with the cause, but we neither identified the tree nor experimented.

The climate itself is not that of Eastern tropics. It is subject to remarkable changes. I have known the temperature drop in Riberalta from 104° Fahr. to 44° in two hours, and the 44° was bitterly cold. During this last year, in August, it fell from 78° overnight to 41° in the early morning. These falls are known as "surasus," or south winds. They last usually two to four days, with much rain, and are common from May to October.

Away from civilization transport is a serious problem. So long as a party is content to navigate a river or proceed by water there is no great difficulty. But river exploration is no longer so necessary. By land the forest must be cut through. In the Verde we progressed through cane brakes and thorny undergrowth about half a mile a day at times.

Mules, which are the best animals for transport, break down on rocky ground from sore feet, are most dependent on good supplies of water, and not very easy to feed over a long period in the forest. In desert country, such for instance as is reported to exist north-east of the Parecis hills in Malto Grosso, or in country cut up by difficult gorges, animal transport must be dispensed with. Heavily loaded, their backs cut up, and are immediately attacked by insects. Any expedition must be prepared to carry its equipment and supplies on the backs of its members.

Added to these disabilities is the difficulty of securing peons. Labour being scarce is very carefully preserved. In Eastern Bolivia it is Indian and Mestizo. Both are unreliable, difficult to please, lazy, and desert without notice. Usually they are unobtainable at any price. Inexperienced white men are more reliable, but of doubtful value. They are only too easily lost in the forest, once out of sight of camp or river, and if they cannot hunt it is difficult to feed them when supplies run short. It is therefore evident that three qualifications are very necessary for South American exploration—a strong constitution, determination, and experience. I am not exaggerating when I say that scores of expeditions into the unknown regions of South America have either been lost, decimated, or rendered abortive for the lack of one or the other of these three qualifications. I only know of three men who have succeeded; one is a Peruvian gentleman and resident in the Acre, who lived for two years with the savages of the Putumayo. His diet was Indian, which he told me was very good, once over the prejudice; but drawing the line at white man, he was forced to escape. The second is General Pando, who, with the loss of four or five, took fifteen men across the Caupolican from the Heath to Ixiamas. The third is Major Rondon, who, with an army of five hundred Brazilian soldiers, is constructing a telegraph line from Cuyaba to the falls of the Madera, and his losses in officers and men have been tremendous, notwithstanding a scientific staff and unlimited resources at his disposal. The foreign naturalists who assert that they have lived with the wild Indians draw upon their imaginations. I have met some of these people.

In Bolivia there does not remain much unexplored country, although a considerable area requires proper mapping. The northern portion of the Caupolican lying to the south-east of the old Peruvian province of Carabaya, and including the river Heath, comes within the operations of my party this year. In the west of the Caupolican were the old missions of Apolobamba, and there are said to be Incan remains; but the wild Guarayo Indians of the Caupolican have never been tamed or brought within the influence of any civilization. The river Heath is completely unknown from a few miles above its confluence with the Madre de Dias. It now forms part of the new frontier with Peru.

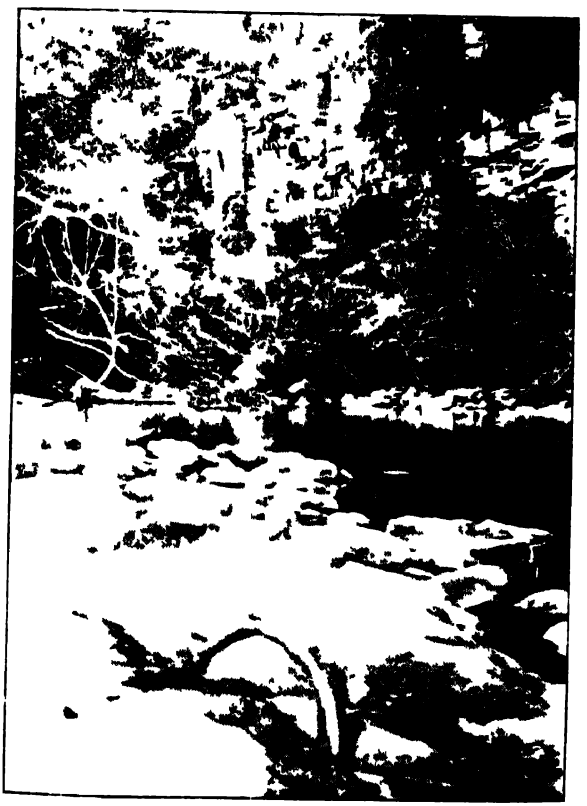
In Brazil and eastern Peru well clear of the Cordilleras there is

an immense area of unexplored country. As I have said before, ou side of the rubber industry, and even to a certain extent within nothing is known of the country or its inhabitants 100 yards fro the river-banks. There is ample scope for adventurous explorers the geography, ethnology, fauna, and flora of these obscure region but it is work which permits of no luxury of food or equipmer The story of Hernandez Pizarro and his trying march from Qui to the Amazon has to be repeated if any considerable force be take It may reasonably have the same quest, for ever since that notal pursuit of an elusive Indian civilization, there have been rumo in the interior of South America of the existence of a strange tri The evidence is necessarily weak. Yet I have met half a dozen m who swear to a glimpse of white Indians with red hair. Such co munication as there has been in certain parts with the wild Indi asserts the existence of such a race with blue eyes. Plenty of peo have heard of them in the interior. They even have a name—t "Morcegos," or bats—the people who travel and hunt by night a hide by day. Some of my informants I have known well, and I beli there may be some foundation for the story. They would appear to nomadic. We know little or nothing about the interior, and the w tribes do not live on the river-banks. Even in easily reached Parag I am told there is a tribe so shy as to be quite outside of communi tion, and another whose men talk one language and its women anot These things are not generally known, and yet it is safer to trave Paraguay than in Eastern Europe. There may be many curious thi hidden in the forests of the Amazon basin. There are rumours of ruins and strange animals—of tracks huge and unrecognized. Fal gather, of course, around unexplored places, but we must not fo that the African pigmy and the okapi were for long discredited. exploration which commences this year may have interesting result

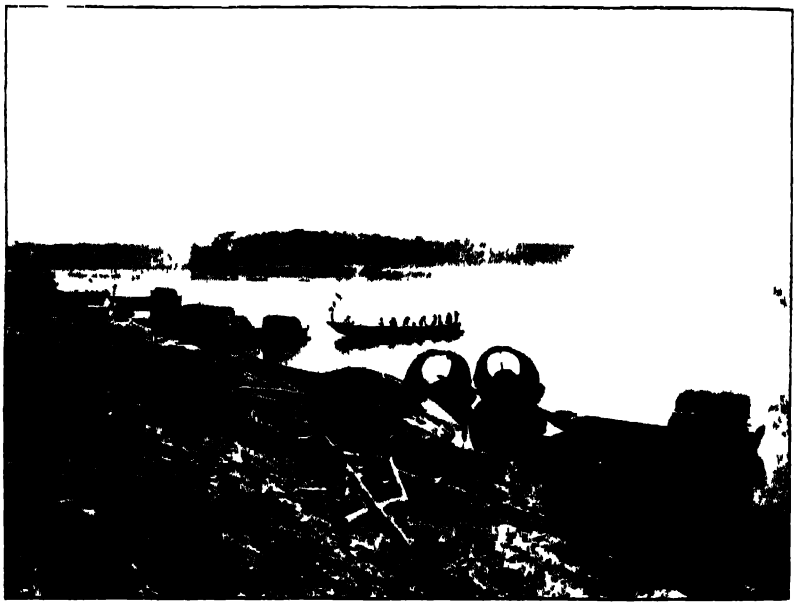
Bolivia has suffered, as all countries improperly organized for always do suffer in the end, from continual loss of territory. In 1 occurred the revolution in the Acre, on the face of it the resentn of a Brazilian population against the misrule of ill-chosen Boli officials, and engineered as these events usually are from the out Bolivia, tied to long and difficult communications, could do noth Such troops as could be transported to the Acre fought splendidly the Bolivian soldier is hard to beat. Ultimately there evolved Treaty of Petropolis, whereby Bolivia ceded some 70,000 square l metres of the Acre to Brazil in return for £2,000,000 and cer territorial concessions giving access to navigable waters in the 1 Paraguay. A new frontier-line was based upon such geograp details as were known or could be surmised, and this is how, in 1 I became connected with the work at the kindly suggestion of my fr Dr. Keltie.



UPPER VERDI



SANDSTONE CANON IN RIO VERDE.



CONFLUENCE OF THE MADRE DE DIOS AND BENE



XAPURY ON THE ACRE.

My experiences commenced in 1906 with a descent of the Beni to Riberalta, a journey which has been described to the Society by Prof. Evans. From here, with Mr. A. J. Chivers as assistant, a young Bolivian, Señor Carlos Dun, and eight Indians found for me by General Pando, I spent a month and a half ascending the river Orton to Porvenir, whence we passed by land to Bahia, or as it is now called Cobija, in the Acre, a point on the frontier important to Bolivia by reason of its direct communication with the ocean. Here we tracked up the Arroyo Bahia, and subsequently spent three months ascending the Acre to a point adjacent to its source in order to discover its relation to parallel 11 S.

Parrots, dense forest, and half a mile of coffee-coloured river cutting a sinuous course in red lacustrine deposit is the tale of months—never the sign of a hill—weeks of laborious dragging of heavy canoes over sharp sandstone rocks—constant vigilance, heavy rains, and not too much food—a story of much small incident and very hard work.

From the Acre we crossed to the Abuna, exploring *en route* the headwaters of the Rapirran and Iquiry in dense forest. From this point Mr. Chivers left for home sick, followed by five of my Indians, rendered useless by fever. I had perforce to descend the Abuna in a small boat with Señor Carlos Dun and three Indians, running the gauntlet of Brazilian outlaws and the Pacaguara savages which infest the lower river.

The Abuna is probably the most unhealthy river in the Amazonas. No one can live on its banks for long. Some six years ago an expedition of two hundred peons explored the Rio Blanco, a tributary, for rubber. All but seven died. In the baracca of Sta. Rosa where we struck the river there were three deaths a week. It was in this river that we killed a huge anaconda, whose dimensions have, I observe, aroused scepticism in some quarters. It was coiled around a trunk and partly out of the water. The Indians were most anxious that we should not shoot, as these reptiles are said to attack small boats if irritated. It measured approximately 48 feet out of the water, and we estimated another 17 feet in—far too colossal a reptile to skin even could we have carried or preserved such a thing, or the Indians had been willing to operate. That it was an uncommon size is probable—that it is exceptional, I doubt; for the tracks of these reptiles from the swamps whence they emerge by night suggest a prodigious size. The Brazilian Boundary Commission in Corumba told me of one killed near that town measuring 85 feet.

Two of my Indians died on my return to the Beni; and Señor Dun has died since. He was an enthusiastic and most plucky companion, who might easily have left his mark on the country. I reached Riberalta in April, and La Paz in November, after two and a half months of most trying journey.

The results of the exploration bring the line of the River Acre, west of Cobija, into the frontier from that village to the confluence of the Yaverija, where enters the new frontier with Peru. Between Cobija and the Abuna, however, there is needed a modification of the line proposed. For the treaty of Petropolis agreed provisionally upon a line due west from lat. 10° 20′ in the Abuna to meet the river Rapirran, at that time supposed to be an affluent of the Ituxy, the ascent of the Rapirran to its source, and a line due west from that point to meet the Iquiry, whence it was to ascend that river and pass by the most defined watershed to the source of the Arroyo Bahia, descending this stream to meet the Acre at Cobija. The Rapirran, however, flows north of 10° 20′ S., and bends round to enter the Abuna in lat. 10° 20′ 15″. The Iquiry, moreover, rises and flows considerably to the north of the source of the Rapirran, whilst in the forest the accidents of the land-surface are for practical purposes unrecognizable. The probable modification is a line from the source of the Rapirran to the confluence of the Arroyo Bahia, or possibly the course of the Abuna and its affluent the Ina, and from the source of the latter a short line to the confluence of the Arroyo Bahia. The trouble is to agree upon a modification in rich rubber forest carrying customs duties. No watershed is easily recognizable in the forest of this region. However, it is a matter for the Congresses of both countries.

On returning to La Paz, I undertook, at the request of the Government, the delimitation of the eastern frontier, where an international commission had from one cause and another been delaying its operations for two years. In May, 1908, therefore, I was in Corumba with a French engineer, Mons. Vaudry, and Mr. F. G. Fisher as assistants. I had a staff, and also a French cook; the cook in fact of the Russian admiral of North Sea fishing-fleet notoriety. This luxury I may say at once was confined to Corumba. The work consisted in a rearrangement of the frontier in the neighbourhood of Corumba, bringing Bolivia into navigable waters; a modification of the frontier in the lakes of Caceres, Mandiore, and Gaiba; and a settlement of a disputed question over the river Verde, an affluent of the Guapore in Northern Matto Grosso.

The geodetical work in the neighbourhood of Corumba was completed in two months, a rapidity which was far from pleasing to our Brazilian colleagues. Beyond a little work in the lakes, there was practically nothing more to do, and the river was too high to permit of the former being completed until September. I, therefore, urged upon the Brazilian Commissioner the opportunity of exploring the Verde. This he declined to do on the justifiable grounds that it required more organization.

Various arguments had been put forward regarding this river: that the Turvo, where the old boundary mark had been located, was

in reality the Verde; that it had been at any rate accepted as the Verde; that it was an old boundary mark of Portuguese dominion; that the river Verde had changed its course, and so forth. In the interests of Bolivia, therefore, I left my competent French colleague in charge of the lake work, and with Mr. Fisher, an English settler named Urquhart, and six peons, set out for the Verde. It was, perhaps, a heinous precedent in international boundary work, and I risked trouble in the event of failure.

This river had given rise to considerable discussion. An international commission of 1878, which delimited the eastern frontier, had passed its confluence with the Guapore in lat. 14° S., and ascending the latter river to the old city of Matto Grosso, had from a high point in the Ricardo Franco hills descried to the south-west a small stream, which they forthwith assumed to be the headwaters of the Verde. They reported the Ricardo Franco hills as impassable, owing to the terrific gorges which cut up its sandstone formation. This report also mentions that two other Brazilian parties failed to enter these hills for the same reason. Later the rubber explorers of the river Paragua further west reported the Turvo as being an affluent of that river.

Old Matto Grosso city, located on a low site on the right bank of the Guapore in lat. 15° S., was the capital of Matto Grosso state, and is said to have had a population of 40,000 Portuguese and slaves in the eighteenth century, principally engaged in gold-washing in the Parecis hills. The decay of this industry, its extreme unhealthiness, and constant trouble with the savages, led to its abandonment in favour of Cuyaba. It suffers to this day from the prevalence of a horrible disease known as "corupcion," which is reputed to kill 80 per cent. of those who merely pass through in the wet season. It has a present population of about a hundred negroes, whom the Parecis and Cabecis savages, who infest the surrounding country, have sworn to exterminate. There is, in fact, a constant war of reprisals. The houses, or propped up mud ruins, are barricaded every night, when savages frequently prowl the streets. It is risky to leave the village alone by day or unarmed under any circumstances.

The Guapore takes its rise in the hills of the Parecis, exactly where is not known, and flowing south to the latitude of Matto Grosso, sweeps round to that city, joined by the Alegre and Barbados rivers a short distance above.

Two leagues west of the city the hills of Ricardo Franco rise abruptly from the forest plains to a height of over 3000 feet, crowned by formidable precipices. Of the interior of these hills nothing was known. They were believed to be inhabited by the Parecis savages. A Bolivian commission to the Turvo in 1906 abandoned the ascent of the hills as too difficult. In 1904 or 1905 a rubber owner in the Paragua attempted to cut into the hills with a large force and failed.

Several private rubber exploring expeditions ascended the Verde from its confluence up to some 20 miles and returned owing to the difficulties and trouble with the savages. The latter had destroyed the old boundary marks at the confluence. A Bolivian, one Antonio Landivar, operated a rubber estate near the confluence for a short time, but was forced to abandon it owing to perpetual attacks by the savages. It may be realized, therefore, that an exploration needed some consideration. From Corumba to the old city of Matto Grosso we were warned not to venture, and were considered mad.

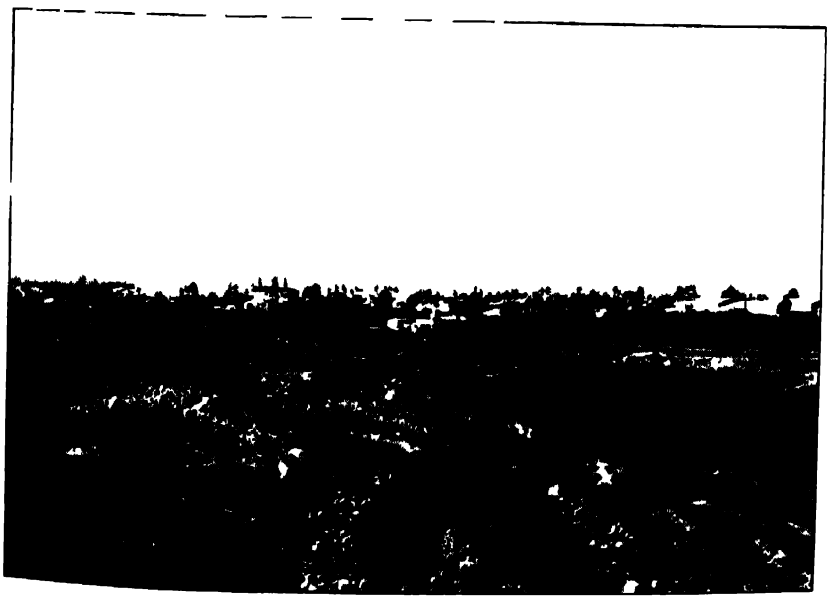
For peons I had two Indians from Chiquitos, an Argentine waiter, a Paraguayan silversmith, and a Spanish baker and tailor, the last four of whom had never held a rifle. They were the only men I could tempt to face the Guapore. For transport I had to chance picking up animals on credit, as the political commissioner, General Pando, was still in Buenos Aires, and I could only raise £200 for a journey in a country where money vanishes like mist under a morning sun.

We availed ourselves of a passing launch to Descalvados, a Belgian cattle station, and thence passed some 250 miles overland to Matto Grosso city. Here I exchanged such animals as I had been able to pick up for two small boats, descended the Guapore to the confluence of the Verde proved the position of that point, in whose latitude I differ from that determined by the Commission of 1878 by some 10″, and then commenced the ascent of the Verde. On the second day we were obliged to abandon the boats owing to the impossibility of dragging them through the rapids, sinking them in the river, and burying all the surplus stores, together with money and various instruments, against our return. On the following day we had to again reduce loads of blankets and the entire food supply, owing to the exhaustion of the peons and the difficulty of getting through dense undergrowth, or climbing over the *débris* and boulders which obstruct the canyon in which the river flows.

We were now limited to hammocks, rifles, ammunition, camera, and instruments, which were distributed over the entire party. The river up to this point had been prolific in fish, and, as I have already said, one can usually depend upon the forest to provide for a small party. I will spare excessive detail of our sufferings. Shortly afterwards the water became strongly impregnated with iron, and bitter to the taste; fish gave out in the river; and game deserted the locality. For nearly three weeks we lived upon occasional palm tops; were eaten up by insects were drenched by a succession of violent storms with a southerly wind bitterly cold for wet and blanketless people; were sometimes climbing all day over boulders, and at other times crawling perhaps half a mile a day through dense cane and thorny undergrowth. With the perpetual damp our boots came to pieces. Two out of four dogs died. We emerged at last with fine weather on to open country near the source of the river, congratulating ourselves that we were through. In view of



RIVER TARUAMANY AT TORVENIR



AREQUIPA



CORUMPA.



VII W FROM CORUMBA WEST.

the state of the party, I abandoned the idea of returning by the river. Moreover, chronometer watches were useless, and longitude could only be obtained by carrying it by latitude and azimuth observations and triangulation through the hills to Matto Grosso. It looked simple enough. Instead of three days, however, we occupied three more weeks. Palms were scarce in the open country, but their place was taken by occasional finds of a very hard and tasteless nut, known as "chunta." The two remaining dogs died. We all, curiously enough, grew deaf for want of food. The peons prayed to be allowed to die, and had to be beaten to make them go on. Day after day we came suddenly upon deep gorges, necessitating long *détours*. The very accidented plateau of the Ricardo Franco is covered by long coarse matted grass, beneath which and out of sight the surface is strewn with sharp boulders, over which we were constantly falling. A tree fell on Urquhart's leg, necessitating a distribution of his load, and Mr. Fisher was bitten by a tucandera. A hot vertical sun did not improve matters, and insects were awful. At the southern end of the hills I shot a deer. It was at very long range for a Winchester carbine, and an absolute fluke; but it saved us, or some of us anyway. It was the only live thing which we saw in the hills, excepting some partridges, which we could not kill. Of savages we saw none. We frequently crossed their tracks, and every night on the open country saw distant fires. A watch was kept every night, or rather supposed to be kept, for I fancy it was observed mostly in the breach. If there were any, they left us alone, as they had previously done in the Acre. We had, however, the constant anxiety of expecting trouble with them.

A few days later we got down with difficulty to the forest, where three black monkeys walked into camp. They disappeared entirely in ten minutes, the peons consuming the skins, fur and all. We also struck three nests of honey. The first was strong and made us all drunk; and the third was vinegary, and left the peons, who alone had no prejudices, in convulsions. We reached Matto Grosso after a week of forest cutting on October 19, and promptly made ourselves sick on coarse sugar, which of all things we had missed most. We were of course extremely thin, which may be better appreciated in the lantern slide, which shows the party after one month of restricted diet. I do not think that the starvation did us much harm. The danger lay in the return to the disease-stricken Matto Grosso in a weak state. Five of the six peons died of the results. I met the survivor this year, a fellow-prisoner amongst the revolutionaries in Northern Paraguay, and he told me of their fate. On November 18 we reached Corumba, where we were warmly welcomed by General Pando and the remainder of the Commission. The result of this exploration has been of great importance to Bolivia. It effectually disposed of all theories regarding the Verde; brought back information of high and valuable country; and made

certain a joint delimitation of the river. In fact this last year the delimitation was carried out.

Such, however, is the honour of the prophet in his own country that our Brazilian friends were inclined to look upon our reports as travellers' exaggeration. They had our maps and reports, and were fully prepared regardless of expense. The latter, however, is not much use in places where everything depends upon questions of transport. One party accompanied me across the Ricardo Franco hills with ladened animals, a journey which, thanks only to the 1908 experiences, was rendered possible.

Another descended the Guapore to follow our route of the previous year and ascend the Verde, carrying everything in shoulder-packs. The engineer of this party had the bad luck to fall badly off the rocks into the river, and was forced to return sick to Matto Grosso with his instruments, leaving a lightly equipped force to follow the river. The engineer who accompanied me arrived sick at the source after eighteen days of certainly trying journey in the hills. In order to carry more food, he had depended for instruments upon the river party. That the northern party, in spite of its information and preparations and absence of instruments, occupied nearly eight weeks before its return to Matto Grosso in perfect weather and with a well-marked route opened from the source of the Verde across the hills, suggests that it had a pretty hard time. I have not heard any details, as we had left Corumba before its return there. The net result is that the work of the Bolivian Commission holds good as the work of the joint commission, and that two years sufficed to complete work for which seven had been anticipated. I more than willingly pay a tribute to the courtesy, competence, and geniality of my Brazilian colleagues. A better lot of fellows it would be hard to find. But they were not young, and it is not given to every one to successfully withstand the trials of pioneering.

Of our boats and buried effects the engineer of the northern Brazilian party encountered only one boat, upside down and high up in the forest on the bank of the river below. The other and all our goods had been washed away. I did, however, meet a story down south of £37,000 in gold buried in the Verde by the Bolivian Commission. Future treasure-seekers may be interested to know that it in reality amounted to £37. I apologize that the account is of necessity cursory; nor does it embrace the thousand and one adventures which are inevitable in such work.

I should like to record my appreciation of the companionship of Mr. F. G. Fisher, who accompanied me in these journeys of the last two years. In such exploration a congenial companion who can take his share of the work and is imbued with that enthusiasm for results which places loyalty before thoughts of personal risk is not so easily to be

found. I should also like to say that the interior of South America calls aloud for scientific exploration.

And when I say "the interior" I do not mean pottering about the Andean slopes, where a debased type of savage is sufficiently tame to have adopted some of the vices of civilization, or the more or less comfortable navigation of rivers, but thorough exploration of those forest regions in the heart of the continent which are still marked "unexplored." The difficulties I have sketched refer to such parts, and here also lies the solution of interesting problems. The old recognized transcontinental highways of trade can be traversed with certain discomfort, and incidents possibly interesting but utterly barren of important result.

It is my regret that difficulties with peons and their hopeless cowardice has prevented me doing more, such, for instance, as returning, as I wished to do this past year, from the source of the Verde by the Parecis hills due east.

It is singular that this continent has been so long neglected, unless exploration is, as some one has suggested, a matter of fashion. Here, however, in these days of luxurious equipment and perfection of organization, the explorer of unmapped corners must return to pioneer methods, and be content with his hammock and his rifle and what a kindly Providence will send him for food. I hope it will be for Englishmen, the race after all most appreciated in South America, to follow their traditions and show the way.

The PRESIDENT (before the paper): Major Fawcett, the lecturer for to-night, was an officer of the R.A., who, both during his service in the army and since his retirement, has done excellent work in surveying. His first expedition was to Morocco in the year 1902, and some account of his expeditions appeared in our *Journal*. But his most important exploratory work was his last expedition, which he is going to describe to-night, an expedition in which he undertook the delimitation of the boundary between Bolivia and Brazil on behalf of the Bolivian Government. Certain short accounts of this work have appeared from time to time in our *Journal*, but I think to-night's paper is the first complete history of his exploration which has yet been given to us. As a Society, we are proud of Major Fawcett, for he went through the course of instruction in surveying at Savile Row, and took our Diploma. We may therefore, I think, look upon him not only as a distinguished explorer, but as one of our pupils.

Colonel PEDRO SUAREZ: In the first place, allow me to thank Dr. Keltie for having recommended Major Fawcett to me in 1906, as he has done a large amount of useful work for Bolivia, and he has done it in such a manner that it has not only been accepted by my Government, but also by the Brazilian Government, which says a great deal in his favour. Major Fawcett has told you a great deal about the wild animals and insects he has met with during his explorations in some of the more outlandish places he has passed through, but I can assure you that the towns are not so bad as you may imagine from what he has said. It is quite true that there is a great number of insects and wild animals, but in regard to the savages, they are greatly reduced in number now. With regard to the question of food

supplies, I may say that my Government has always provided plenty of provisions for the different expeditions, and on the last occasion I doubled the list of provisions that Major Fawcett and Mr. Fisher requested me to order for them. The difficulty has been in obtaining sufficient animals to transport goods for the very long journey they had to undertake, and the proof that they had a sufficient supply of food is, that when they returned to Matto Grosso they presented the Brazilian Commission with what remained. As Major Fawcett has informed you, undoubtedly Bolivia is the land of the future, as it is progressing rapidly with the new railways that are now under construction, with English capital. My Government is so well satisfied with the work performed by Major Fawcett and Mr. Fisher, that I have been instructed to engage two more English officers and six non-commissioned officers for the frontier work. I am sorry not to see here to-night the old familiar face of the late Colonel Church, who took such an interest in all the Latin American countries, and who knew more about Bolivia than any Bolivian, but I am pleased to see here some others who have been there; for example, Sir Martin Conway, who has climbed the highest mountain, and who can undoubtedly tell you something about La Paz and other towns in Bolivia. I must conclude now by thanking Major Fawcett for the interesting paper he has read about my country.

Sir MARTIN CONWAY: I am thankful to say I have not been in the parts of Bolivia described here to-night. I think it is not difficult for us now to explain how it comes about that the forest region of the Amazon should be the last portion of the world remaining to be explored. You must be careful not to conclude that all Bolivia is a land of this description, as it were a portion of the Tertiary world surviving into our own day. These gigantic reptiles, all this strange life, of which we have been told, seem to belong to a past geological period. The unknown has an immense attraction for every one, and especially for adventurous souls, so that perhaps what we have heard, for all its horrors, may act as a kind of challenge to some to go forth and discover. Certainly, for the naturalist this region must be intensely interesting. I prefer the higher lands. Bolivia possesses the remarkable quality that it contains regions of almost every kind. There is, I think, no country in the world where you have, within a territory only five times as big as the United Kingdom, not only this remarkable rich forest district, low-lying, tropical, and, almost within view of it, mountains, 21,000 and 22,000 feet in height, covered with great glaciers and perpetual snow; but besides snow-mountains and tropical forests Bolivia has regions of utter desert, and out of them strange volcanic, extinct volcanic, mountains rise, their flanks displaying all kinds of coloured rocks, and around their bases great dried-up lakes, now represented by expanses of white salts spread abroad over vast areas. All this part of the country resembles a portion of the surface of the moon. In Bolivia you have also fertile regions something like the Italian lakes or the West Indies, rich beautiful regions filling the belt between the high snows and the forest swamps. This is a region of undulating hills, fertile, beautiful in form, a region as fair, as lovely, as any on the face of the Earth. Well, you may imagine that in a country like this, so varied in its surface and so enormously rich in its undeveloped resources, a country, moreover, inhabited by a brave people—a people (I refer not, of course, to the forest folk, of whom we should like to hear a great deal more, but I refer to the population of the higher regions) in whose veins flows the blood of the best families of Andalusia and of the governing caste of the Incas. They are, moreover, an imaginative race also, and intellectually well endowed, for whom a great future undoubtedly waits. About such a country and such a people, it is, I think, quite certain that there will be a story hereafter to tell.

Mr. W. S. Barclay: Major Fawcett's lecture referred to the extraordinary progress that has been made in South America during the last decade. There are certain things that we all recognize, and that is one of them. South America is furnishing to-day a very large proportion of the foodstuffs and raw materials which we require in Europe. Argentina exports more cereals than Canada. Three-quarters of the world's coffee and half of the world's rubber still comes from Brazil. We have heard of the depletion of forests. The largest, densest, and most valuable forests in the world cover over a million square miles in the Amazon and Alto Parana basins. Meanwhile, South America manufactures very little. I know of no instance so striking as the town of Buenos Aires, which, apart from foodstuffs, practically lives on imports. This is also largely the case in Peru, Brazil, and Bolivia. Countries in these conditions, supplying food and raw materials, and absorbing manufactures, are bound to receive great attention from European nations.

On the North American continent settlement began on the Atlantic coast, and it spread west to the Pacific, across the inland plains and over the Rockies. In South America the nations early planted themselves on both coasts. Thus, while in North America the trend of railways and lines of communication has been from east to west, in South America the tendency has been from either coast inland. That tendency, due to competition among nations occupying the coast-line, has been very much hastened of late years. Four lines are to-day converging towards the region which Major Fawcett has shown us to-night. In the south railroads are stretching up from Argentina. Within twelve months we shall have through rail communication between Ascension and Buenos Aires. In the north the most important strategical line on the South American continent, the Madeira-Mamore railway, will be completed within three years. This line will handle the traffic between the upper and lower Amazon basins. From the east comes the São Paulo-Corumbá line, across Brazil. Already they are building a bridge over the Alto Paraná river, while the Corumbá section has been completed and will be opened next September. And westward, Major Fawcett has told us that a railway connecting the plateaux to the lowlands of Bolivia is almost inevitable.

Thus we see four lines all converging upon this district, the very heart of South America. The methods by which they advance are perhaps not all that geographers could wish. The gentlemen who build them might with advantage study more of the country before they start construction. When Colonel Church projected the building of the Madeira Falls railway, he roughly surveyed the whole of the upper basin of the Madeira, as far as its water-parting with the Paraguay river. As a consequence his deductions, made forty years ago, still hold good to-day. I would ask any one familiar with railway enterprise in South America to say if it is not true that millions of money have been wasted for want of adequate survey and mapping beforehand, of which the total cost would have been very small, and the benefits incalculable. I would suggest that the board of every South American railway make it a *sine quâ non* that their general managers on the spot should also be Fellows of the Royal Geographical Society.

When one talks of lines of communication, the problem bound up with it is the development of the country. It is no good building a railway if you have got nothing to haul on it. In colonizing these hinterlands it is best to tackle the open prairie before the forest country, and anybody who settles in pampa land ought to take with him as many cattle as he can and a box of matches. By burning the long grass and rushes constantly an enormous number of insect pests are destroyed, while the cattle-tracks form little paths which help swamp-water to drain off.

One final point. Most of the transport lines in South America are altogether too modest. They hide their lights under a bushel. Not only do they descry all knowledge of each other's time-tables; they do not appear to know that any competing line even exists. Now, it does not cost very much to get up a little book to tell about yourself to interested people; it is not much trouble, if you have drawn a map, to send it to the Royal Geographical Society. But South American railway, telegraph, and steamship lines never dream of doing either. I suggest that they co-operate with the public more in this and other matters. If we could go to some agency and book an inclusive passage through South America at an inclusive price, so as to be sure of returning at a given date, it would be a great step gained. Co-operation, publicity, and enterprise are what is wanted, and with these the next ten years should see an enormous advance in South American travel.

Sir THOMAS HOLDICH: My experience in South America and in boundary delimitation never took me as far as Bolivia, and after hearing Major Fawcett's description of that charming country, I can only say, with Sir Martin Conway, how glad I am I was not there. It is on an occasion like this that we miss the voice of our great South American expert, Colonel Church, who has passed from us. He had always something interesting to say, and something new, but he never told us of such remarkable experiences as those which Major Fawcett has described to-night, and I was not prepared to hear anything like so much of the extraordinary difficulties of dealing with boundary demarcation in Bolivia, after my own experiences further south. I think that this Society may take to itself very great credit for having turned out a surveyor of Major Fawcett's capability. If we can only succeed in putting a few more men like Major Fawcett into the field (as he himself proposes), I think that our geographical school may well say that it justifies its existence.

The PRESIDENT: Geographers have on several occasions expressed surprise that these interior wild regions of South America have not been more thoroughly explored. Major Fawcett has expressed that opinion, but I think he has given better than any one else the reasons why travellers have not more frequently pushed into the interior. The obvious reasons are the discomfort, the difficulties, and the dangers of such journeys, for the picture he has drawn us has been a picture of famine and death, with a background of insect bites. The work he has so well described to us has been an admirable bit of work. Major Fawcett will, I am sure, never get over his love for exploring, and he is, in fact, about to set forth for South America once again. He will go forth with the most hearty good wishes of every one in this room, and of the Society which I have the honour to represent.

PROGRESS OF SURVEY IN THE ANGLO-EGYPTIAN SUDAN.*

By Captain HUGH D. PEARSON, R.E., Director of Sudan Surveys.

WHEN the campaign of 1896–98 was entered upon, we possessed, thanks to explorers from nearly every nation in Europe, a rough general knowledge of practically the whole of what is now known as the Anglo-Egyptian Sudan.

* For much of the matter in the early part of this article I am indebted to old reports written by Colonel Talbot.

Sir William Garstin, in his lecture delivered before the Society in December, 1908, dealt more particularly with Nile exploration and its results. In the present article I propose to outline very briefly the survey operations carried on during Sir William Garstin's second period, viz. from 1898 to the present day, dealing with the Sudan as a whole, without special reference to the river.

The area of the country which we, in conjunction with Egypt, assumed responsibility for after the battle of Omdurman amounts to approximately 950,000 square miles. A continuous network of primary triangulation covering this vast area must have taken many years to complete, and would have cost a sum of money altogether out of proportion to the value of the country.

Survey, however necessary and economical in the long run, brings in no immediate return, and with a revenue estimated at but £E.8000 in the year 1898, it was hardly to be expected that money would be forthcoming for the purpose. The revenue has at the present time reached one million sterling, but the calls on the Government purse have increased in proportion, and it has been necessary to make the most of the very limited resources at our disposal.

To the north of the Sudan rain is scarce and desert predominates, and, except in the immediate neighbourhood of rivers and khors, cultivation is practically non-existent. Minerals are to be found near the Egyptian boundary and along the Red sea. In the Halfa and Dongola provinces hardly a square metre of land which can be made cultivable is allowed to lie fallow. The close investigation of rivers and khors, with a view to adding to the areas which can be made productive, is therefore of importance.

South of Khartum, in a country of moderate rains and good soil, are the gum forests, a very valuable source of revenue. In years of favourable rainfall, the land is very largely cultivated. The most thickly populated part, however, between the Blue and White Niles some 50 miles south of Khartum, is precisely that part where the rains are most uncertain. It is from this zone that the first real advance in the development of the country may be expected, and the prosperity of the Sudan largely depends on the possibilities of irrigation.

Further south, again, is the country of the Negroid tribes, a country of torrential rains, where at present only sufficient land is cultivated for the very modest local needs. The southern Sudan is rich in cattle, and may prove valuable for rubber and rice plantations, but its importance is chiefly due to the fact that it is from the upper Nile that Egypt must look for an increased water-supply.

The considerations, then, that have governed the policy of the Survey Department have been, in the first place, the necessity of good general maps for administrative purposes, showing clearly the lines of communication. As no general scheme was possible, except at prohibitive

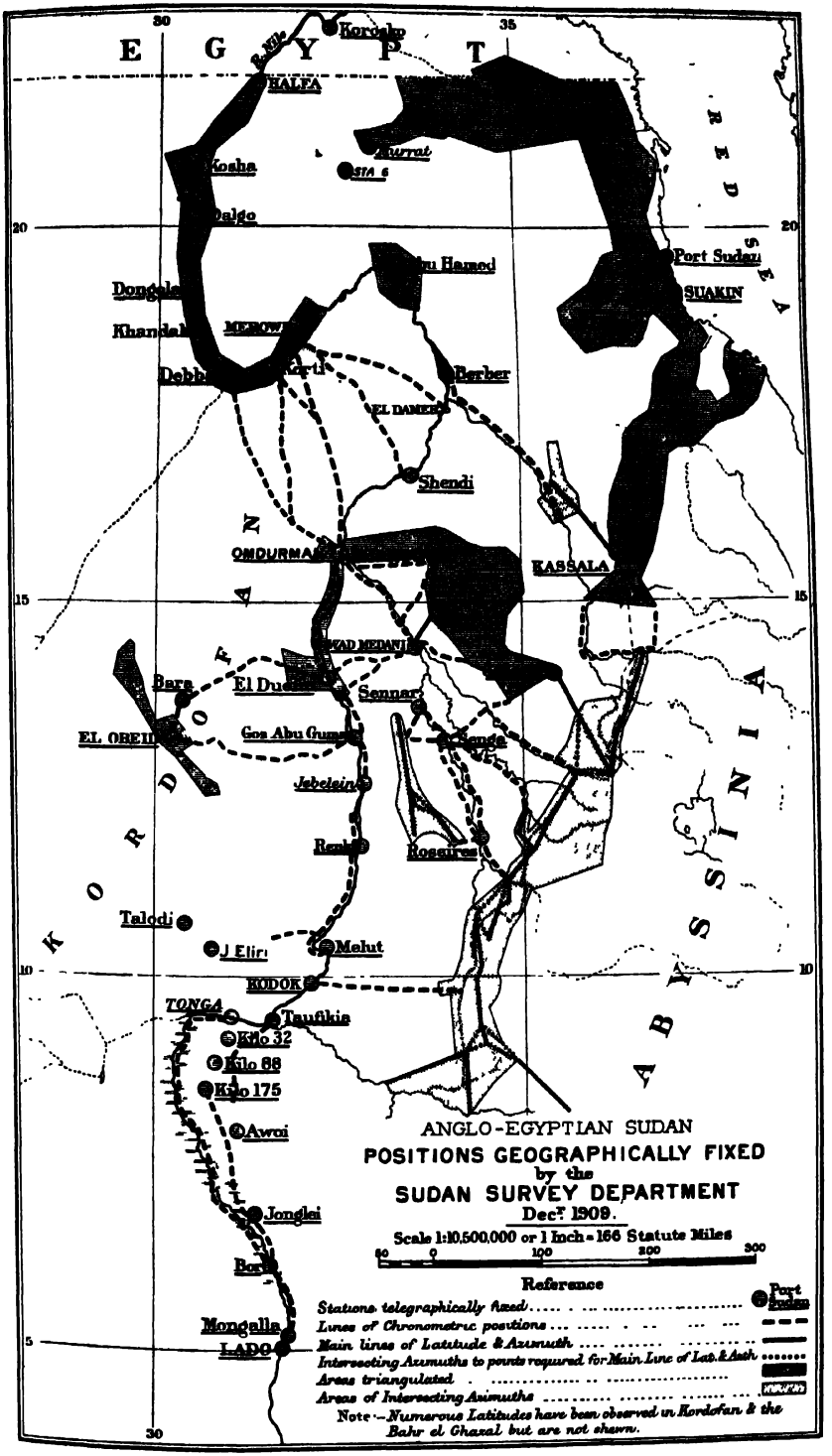
cost, it has been left to local requirements to indicate from time to time the directions where more detailed survey was desirable. Thus the boundaries of mining concessions were the primary cause of triangulation in the neighbourhood of the Murrat wells; the Abyssinian and Eritrean frontiers necessitated a detailed survey of the eastern boundary; cadastral survey and land concessions, involving the investigation of native rights, have demanded maps of a high degree of accuracy; and irrigation questions have been responsible for the closer exploration of the upper Nile and Zeraf rivers.

The several surveys have thus been started independently for the definite purpose required, and the work of connecting the various triangulations has been left till opportunity occurs. For the rest, the survey staff available have been hurried from one part of the Sudan to another to enable maps of the degree of accuracy necessary for administrative purposes to be produced at the earliest possible date.

The survey has been regarded from a practical point of view only. A high standard of accuracy is uncalled for, no hills have been contoured, and the 5-inch micrometer theodolite is the largest instrument used.

Colonel Talbot, the first director of the Sudan Survey Department, had, while at Halfa in 1893, fixed that place by telegraphic comparison with Cairo, and started a small triangulation. In the same year he accompanied a patrol into the western desert and fixed the position of certain wells. The year following a triangulation was commenced from Suakin, based on the positions shown on the Admiralty Chart. In 1896 a triangulation was started from Murrat, and, with the advance to Dongola, the Halfa work was carried south to that point. During the next two years, Colonel Talbot continued, whenever the time could be spared, to fix positions along the Nile valley. Merowi was telegraphically fixed, and a small triangulation commenced. Points between Merowe and Abu Hamed were determined, another triangulation started from Korti, and in 1898 a number of positions were observed while accompanying a force marching from Merowi *viâ* Jakdul to Metemma. It was in this year, also, that the Marchand expedition, which had traversed the Congo-Nile watershed and marched through the Bahr-el-Ghazal, arrived at Fashoda, materially adding to the information we possessed of the Southern Sudan.

In 1899 operations were undertaken by Colonel Talbot to fix telegraphically the position of Omdurman. The Mahdi's tomb was selected as the best point of reference, and a triangulation was commenced. In January of the following year, however, Colonel Talbot had to leave for Kassala for the purpose of arranging the Sudan-Eritrean boundary with the Italians. A base was measured at Kassala, and a triangulation started, which was afterwards carried north by Major Gwynn, and joined on to the 1894 work. Observations were then carried on between


E G Y P T
Korosko
HALFA
Kosha
Atbara
STA 6
Dalgo
Port Sudan
SUAKIN
Dongola
Khandak
MEROWE
Debba
Berber
EL DAMER
Shendi
OMDURMAN
KASSALA
KHARTOUM
Bara
El Duem
Sennar
EL OBEID
Gos Abu Gumaa
Singa
Jebelain
Rashad
Rosaires
Taloddi
El Eliri
Melut
KODOK
TONGA
Taufikia
Kilo 32
Kilo 68
Kilo 175
Awoi
Jonglei
Bor
Mongalla
LADO
KORDOFAN
ABYSSINIA
RED SEA
ANGLO-EGYPTIAN SUDAN
POSITIONS GEOGRAPHICALLY FIXED
by the
SUDAN SURVEY DEPARTMENT
Dec. 1909.
Scale 1:10,500,000 or 1 Inch = 166 Statute Miles
0 100 200 300
Reference
Stations telegraphically fixed
Lines of Chronometric positions
Main lines of Latitude & Azimuth
Intersecting Azimuths to points required for Main Line of Lat. & Azth.
Areas triangulated
Areas of Intersecting Azimuths
Port Position
Note.—Numerous Latitudes have been observed in Kordofan & the Bahr el Ghazal but are not shown.

Suakin and Khartum and resulted in a new longitude being accepted for the former place.

In 1901 and 1902, Colonel Talbot had to revisit Murrat and to proceed to Deraheib in connection with mining concessions. The Murrat triangulation was continued east and west.

Several Egyptian officers had now joined the department. They were chiefly employed with subtense instruments in sketching the rivers, the Nile, the Rahad, the Dinder, the Atbara, and their work, checked by latitudes and chronometric longitudes, was extended in directions where less detailed sketching sufficed. Positions were fixed between Omdurman and Wad Medani, across the Gezira between Wad Medani and Dueim, between Dueim and Obeid, between Wad Medani and Gedaref, and up the Blue Nile to Roseires.

During 1902 and 1903 Major Gwynn was almost exclusively employed on boundary work. The triangulation commenced at Suakin and connected to the Kassala work was carried a considerable distance south till it gave way to latitude and azimuth fixings. Further south still from the Sobat to Lake Rudolf, Major Austin's expeditions had supplied much information.

In 1903 it became necessary to fix the point of intersection of the 5° 30′ parallel of latitude with the Bahr el Jebel, the northern boundary of the Lado Enclave. A number of places were fixed during the journey, and Captain Lyons and Mr. Craig added information, enabling a fairly accurate map of the river to be produced. In the same year Major Liddell and Captain H. H. Wilson were at work in the upper Nile provinces, and Captain Lloyd made many useful sketches in the northern part of the Kordofan province.

The Survey Department itself still consisted of two Englishmen only, assisted by four Egyptian officers, but by this time much information, usually in the form of time and compass sketches, executed by the province officials, was being received in Khartum. It was possible to make use of a number of these sketches at once, but others could not be utilized without more fixed positions. Every endeavour was made by Colonel Talbot and Major Gwynn to provide the positions necessary, either by latitude and azimuth, or by latitude and chronometric fixings. Points were so determined between Kassala and Geili and Khartum, between Omdurman and Korti, Korti and the Bayuda wells, Merowe and El Damer, etc.

In 1904 Major Liddell explored a telegraph route south of Taufikia to the Twi country, and observed latitudes and chronometric longitudes at Meshra, Wau, Tonj, Rumbek, and other stations in the Bahr el Ghazal. Mr. Dupuis with Captain Wilson fixed many positions on the Khor Filus and on to Bor, and a number of latitudes were observed by Captain Lloyd during his expedition to Rikitas.

The need of cadastral surveys over the cultivated areas now began

to be felt. A commencement was made in the Dongola province by surveyors lent to the governor. The maps produced were all that was immediately necessary to arrive at the areas of properties, but they rested on no framework, and could not be joined together so as to give a general map on a smaller scale. The method adopted was simply a plane-table survey of collections of sagias (plots of land irrigated by water-wheels), executed by means of telescopic alidade and 20-metre chain. The scale was 1 : 2500.

At the end of 1904 Major Gwynn resigned his appointment, and early in the next year Colonel Talbot also left the country. During the time he had held the post of Director of Surveys fifty-five sheets of the Sudan on the 1 : 250,000 scale had been published, provisional sheets had been got out of the Kordofan province on the 1 : 500,000 scale, and four sheets had practically been completed on the million scale.

During 1905 cadastral survey almost exclusively occupied the time of the officers of the department. Work was started in the Berber and Khartum province, and a scheme prepared for dividing up the Gezira between the Blue and White Niles into "minute" squares. At the same time classes were arranged for training Gordon College and other Sudan schoolboys in plane-table work. This class of survey, applied merely to the fixing, by intersection or tape, of the boundary pillars of properties, has been very readily picked up by the boys. Instances have occurred, too, where the native labourer, employed carrying the plane-table to a new station, has been found to have correctly oriented and clamped the table ready for the surveyor, and more than one of these labourers are now among the regular plane-tabler staff of the Department. The work has reached a high standard of accuracy, and an error of as much as 2 metres in the position of a boundary pillar is very rarely found, while the draftsmanship displayed has been altogether surprising. Parties have been organized into sections of four plane-tablers, each under an Egyptian overseer, while two, three, or more of such sections are under the supervision of an English inspector. The Egyptian overseers are now gradually being replaced by the older and more experienced of the Sudan schoolboy plane-tablers.

The areas of properties are also taken out by native schoolboys, trained to use the planimeters and sliding scale, the computing office being under an English draftsman recruited from the Ordnance Survey Department in England.

Time did not permit of a triangulation being run down the banks of the Nile before the detail party were set to work. A series of closed traverses was accordingly substituted, and the traverse stations, iron pipes fixed in the ground, co-ordinated and plotted on to plane-table sheets, and the detailed mapping made in kilometre squares.

Halfa, Dongola, Berber, and Khartum provinces have now been

surveyed in this manner, covering approximately an area of 585,000 acres, the plots ranging in size from about 2 to 20 acres. In the Gezira, where survey is still going on, an area of 530,000 acres has already been mapped.

The expenditure on the Gezira work has been £E.29,600, which works out to a rate of 55 milliems per acre (about 1s. 1d.). These figures, which include the laying out of "minute" squares covering an area of 4000 square miles, together with the cost of the permanent iron beacons erected, do not, however, represent the true cost of the survey.

Difficulties of settlement have very seriously affected progress; the trouble in the Gezira, which occurred in the middle of the working season of 1907, certainly cost us six months' work, and the delay inevitable in starting new work, occasioned by problems of demarcation and registration, etc., have all combined to enhance the expenditure. It is probable at the present time, with the work in full swing, the cost would work out to about half the amount given above.

During 1906 Colonel Talbot's triangulation, which in 1897 had reached Dongola, was further continued to Merowi, ending at J. Barkal The traverse run between the triangulation stations so fixed enabled the plane-table sheets to be fitted together and utilized for smaller-scale maps. In 1906, also, and the following year, Captain Coningham, who had joined in Major Gwynn's place, continued the Suakin triangulation through the hilly country bordering on the 22nd parallel, and effected a junction with the Murrat work and the work of the Egyptian Survey Department across the boundary. Captain Coningham then started work in Kordofan, but was recalled to accompany a patrol into the desert west of Dongola, and map the positions of the wells and tracks.

In the mean time the Irrigation Department had been busy running lines of levels and surveying the Zeraf and Jebel rivers. The telegraph line had reached Bor. To give points on to which the Irrigation Department surveys could be tied, an expedition was made up these two rivers, and telegraphic longitudes fixed at intervals.

During 1907 Captain S. F. Newcombe, R.E., was sent to the Lado Enclace to examine, in conjunction with Belgian Surveyors, possible routes for a railway connecting the Congo with the Nile valley. The Enclave is about to be handed over to the Anglo-Egyptian Sudan, and the large amount of information collected and the maps produced should prove of great value.

In 1908 the work started in Kordofan was continued, but, owing to unrest in some of the southern jebels, it was thought best to postpone operations. In the autumn, however, Captain Coningham accompanied the Nyima patrol, and carried on a plane-table triangulation for a considerable distance further south, adjusting his work to telegraphic positions fixed in the south of the province. As a result of these last

two years' work a backbone of fairly accurate work now runs from the wells in the desert west of Dongola, across the Wadi Melh, through Bara and El Obeid, on through the Nyima Jebels to Kadugli, Talodi, Eliri, and Lake No.

At the close of the operations in the Nyima Jebels, Captain Coningham marched to the western Bahr-el-Ghazal. It had been intended that he should follow as far as possible the course of the Bahr-el-Arab, but inter-tribal disputes rendered this inadvisable. Captain Coningham carried watches, and had a perambulator with him, and he also took the longitude instrument invented by Mr. E. H. Wade, of the Egyptian Survey Department. This instrument, the first of its kind, had been designed for observations of equal lunar distances, and it was hoped that a few longitudes might be so determined. The instrument had been put together in Egypt, and had hardly passed the experimental stage.

Captain Coningham found considerable difficulty in working it, and eventually cloudy weather and mosquitoes forced him to abandon his attempts. Fair values for longitude were, however, obtained by means of his chronometers and wheel for the position of Hofrat el Nehas and other stations, and the previous maps have been considerably modified. Captain Coningham is now at work in the Burun country to the north of the Sobat.

The maps of the Southern Bahr el Ghazal have been adjusted to the fixings assigned to places by Commandant Lemaire and the officers of the Belgian Expedition of 1904–1905, and the only large stretch of unexplored country remaining is that portion to the east of the Bahr el Jebel, south of the Sobat.

Since the necessity of cadastral survey became recognized, the two Egyptian officers, left to the department, have been so employed, and Captain Coningham alone has been available for purely topographical work. The cadastral survey sheets have been reduced to a scale of 1 : 50,000, and the topography in the immediate neighbourhood added. These sheets are now being reduced to furnish the first accurate map of the Nile valley south of Halfa.

The plan initiated by Colonel Talbot is being followed. His triangulations are being extended as opportunities occur and local conditions require. Advantage is taken of the extension of the telegraph system to fix wherever possible telegraphic longitudes. Latitudes are now observed by at least three Sudan officials, and connected with the survey department, who have been provided with spare instruments and coached in their use. Where the telegraph has not reached, and neither triangulation nor latitudes and azimuths can be run except at prohibitive cost, wheel and compass sketches are made and checked by chronometric longitudes and observed latitudes. Railway reconnaissances, telegraph reconnaissances, and the Irrigation Department's lines of levels and

explorations have furnished other lines of a considerable degree of accuracy.

The remainder of the topographical information we possess is due to the time and compass sketches executed by civilian and military officials. A very large number of such sketches, of varying quality, have been made, and the circumstances which have caused the members of the department to hasten from one part of the Sudan to another, have, at any rate, enabled a number of positions to be fixed, on to which the sketches can be adjusted. The last entry in the receipt book for these sketches is No. 560, and if any credit can be claimed from the fact that, at the present time, all but three sheets of the inhabited portion of the Sudan are available for issue on the 1 : 250,000 scale, it is to the Province officials that the chief share is due. Without their co-operation the maps must have remained to this day little more than skeleton sheets. One hundred and twenty sheets are now published and procurable in Khartum, fifty-five of these have been lithographed in England, twenty-one have been zincographed in Khartum, and the remainder are issued as sun-prints.

On the million scale, too, sheets have been brought out of the whole of the Sudan either in the form of sun prints or lithographed maps, and wall maps, made up of these sheets fitted together, have been issued to the head-quarter offices. It is gratifying to note the extent to which Sudan maps are used, as it is only from a general use that we can hope to hear of inaccuracies and omissions. During 1909 no less than 4200 sheets were issued from Khartum alone.

One consequence of the unorthodox method of survey adopted is that a very great deal of revision is always in hand, and often the only revision possible is a complete redrawing of the sheet. As time goes on and more astronomical points are fixed, and the triangulations joined up, the revision necessary should gradually diminish.

The difficulties of keeping the maps up to date are much increased by the fact that the positions of villages are constantly changing, new villages are being built, and the names, often called after the headman, alter as soon as the sheikh dies. As in other parts of Africa, it often happens that travellers, going over the same roads, will furnish entirely different names for the villages, hills, and rivers they have passed, and in many cases it is by no means easy to identify the routes followed.

At the present time no single sheet can be considered final, and many are of very doubtful accuracy. Practically, however, maps were required for administrative purposes, and, rightly or wrongly, it was felt that a map, however inaccurate, was better than none at all. Compilations have therefore been hurried on, and criticism invited in the hopes that even in the absence of the ordinary survey checks, something fairly reliable may be eventually arrived at. The map attached will, I hope, in some measure help to clear up a record of the present state

of the survey in the Sudan, which, I fear, will prove most difficult to follow.

Mention has been made above of the Cadastral survey work of the department. Town surveys have also been undertaken, and those of Halfa, Berber, Atbara, El Damer, Shendi, Rufaa, Singa, and Gedaref have been completed.

The town of Omdurman comprises some 10,000 compounds, and with building land reaching the fictitious value of 10*s.* per square metre during the boom of 1907, a systematic survey became indispensable. The work is now approaching completion. The scale 1 : 500 was adopted, the town cut up by main and subsidiary traverses adjusted to trigonometrical stations, and the detail plane-tabled in, in many cases from the tops of buildings. A maze of ruins existed, and often the only entrance to a particular plot was through the property of the neighbouring owner.

The natives are now rebuilding on a very large scale, and much of the time of the Town Survey staff is occupied in fixing the alignments of the new compounds so as to fit in to a scheme for a new and sanitary town laid out with the necessary roads and lanes.

THE DANISH NORTH-EAST GREENLAND EXPEDITION, 1906-8: PROVISIONAL RESULTS.*

By Dr. J. LINDHARD.

THE moving spirit of the whole undertaking, the expedition's founder and leader, was L. Mylius-Erichsen. He succeeded after unwearied toil in obtaining so much support for his projects, both from private individuals and the state, that the vessel of the expedition, the *Danmark*, was ready to sail in June, 1906.

Mylius-Erichsen's plan was to drive the vessel during the late summer of 1906 as far north as possible, and to establish at the most northerly point a large depôt for future sledge journeys; then to seek a winter haven for the ship in the neighbourhood of Cape Bismarck, and from here to map the unknown north-east coast with dog-sledges in the early part of 1907; in the latter part of the year to sail in the vessel southwards to one of the most northern arms of the Kaiser Franz Josef's fiord, whence the voyage home might be considered assured; and in the early part of 1908 to undertake a sledge journey across the mainland to one of the most northerly Danish colonies, this detachment rejoining the main party of the expedition in Angmagsalik, whence all would return home.

This plan had, indeed, in consequence of several circumstances, to be modified in various points. The most important alteration, which however had no serious effect on the scientific work, was that the

* See *Geographical Journal*, vol. 33, p. 40, and map, p. 116.

vessel remained at its anchorage, "Danmarkshavn," in 76° 46′ N. lat. and 18° 30′ W. long., from its arrival at the coast in August, 1906, till our departure in July, 1908.

In the following pages I shall describe the work executed by the expedition during the period mentioned, and give some account of the material brought home and the preliminary results. A general survey of the scientific material will be published, partly in English and partly in German, in the *Meddelelser om Grönland.*

The chief aim of the expedition was geographical survey, its extent and limits being determined by the work of former explorers.

In 1870 the sledge party from the *Germania* expedition reached lat. 77° 2′, but owing to unfavourable travelling conditions the mapping work became very defective even at 75° 43′, the coast about Teufel cape and in Dove bay, as well as the outer land near Cape Bismarck, remaining quite unexplored. In 1905 the *Belgica* sailed along the outermost islands from about lat. 76° to 78° N. This expedition succeeded in determining in general the coast-line up to 78°, and ascertaining the existence of land up to about 79°. From 79° to 82° the land was entirely unknown. In 1892 and 1895 Peary travelled from Cape York over the inland ice, and in lat. 81° 40′ N. and long. 35° W. came to land which he naturally assumed to be part of the east coast of Greenland. He at the same time found that a large fiord or sound stretched from the east to the south of Peary Land, so that this must be assumed to be an island. In 1900 Peary travelled northwards from Cape York, passed the northern extremity of Greenland, and proceeded down the east coast as far as 83°. The last stretch of coast was less exactly surveyed owing to unfavourable weather.

The task of the *Danmark* expedition was, therefore, to map the east coast of Greenland from 75° 43′ northwards to about 83° 30′, a distance which might be estimated beforehand at not less than 620 miles. All the work was accomplished by sledge-journeys, as the ice conditions rendered it impossible to take observations from the ship. The instruments consisted of six small Hildebrandt travelling theodolites with their compasses, six pocket chronometers, six Zeiss binocular field-glasses, pocket aneroids, sling thermometers, etc.

The annexed sketch-map * gives some idea of part of the results. Especially noticeable is the fact that Greenland extends much further eastwards than had been expected. The unknown part of the coast-line proved to be fully 180 miles longer than calculated, and to enclose an area of about 13,000 square miles. The sketch-map is compiled from a calculation of the most important observations.

The material collected comprised—

A. Astronomical determinations, including azimuth readings, executed at about 160 stations.

* See previous note.

B. Triangulation determinations of places at about 35 stations.

C. Measurements of horizontal angles and levellings executed at about 200 stations.

D. Perspective sketches and map-sketches about 150, some of especial topographical interest.

E. Artistically executed sketches in pencil, about 120 landscape paintings and sketches in oil, as well as very numerous photographs.

Besides the general geographical survey, triangulation and base measurement were included in the programme of the expedition. Such work was considered desirable, partly as a groundwork for special maps, partly to render possible a connection with the German triangulation on Shannon island and Hochstetter's foreland, and lastly in connection with the proposed investigation of terrestrial refraction. The base-measurement was carried out on a level stretch just to the north of the permanent observatory, which, in summer a swamp, was at the time of the measurement frozen and partly covered with snow. The terminals of the line were marked by two bronze standards secured in solid rock. The measurement was made with a 24-metre steel ribbon, which had been adjusted at the standard base of the General Staff, in Copenhagen. The line was measured nine times in all, and the preliminary calculation gave as result a length of 1450 metres (4757·2 feet).

In September, 1906, the work of reconnoitring and erection of marks was proceeded with at twelve stations in the environs of Danmarkshavn. A cylindrical pillar was carefully built up, and its axis formed by a bronze rod, which was driven into a hole bored in the rock. The measurement of angles was continued from September 8 to 28, 1906. Horizontal angles were measured in three sets, vertical angles (trigonometrical levelling) in two sets. To obtain a starting-point for levelling, the zero point from the expedition's water-level measurements was carried to a zero post on land, and thence in a loop on to the permanent observatory and the ends of the base. At the end of the same year the permanent observatory was connected with the triangulation network.

These preliminary observations were executed in the first winter. The following year the triangulation network was extended westwards to the Orientirung islands and Hvalros (walrus) point and southwards to the Haystack, whereby a connection, though somewhat uncertain, was effected with the survey of the *Germania* expedition, so that it was possible to take advantage of this expedition's determinations of longitude and those carefully executed by Sabine on the Pendulum islands.

In view of the importance of detailed maps, not only for the topographical description of the country, but also for other scientific

investigations of the expedition, ethnographical, botanical, and zoological, the following works were executed :—

1. Plane-table survey on the scale of 1 : 50,000 of Danmarkshavn and its surroundings, 52 × 52 centimetres (20½ inches). Area included about 260 square miles, but a large part of it water. The relief of the ground was indicated by contours at intervals of 10 metres (33 feet).

2. Plane-table survey on the scale of 1 : 100,000 of Danmarkshavn and its neighbourhood, 52 × 52 centimetres. Area about 1040 square miles, more than half being water. This map extends on all sides beyond the limits of the foregoing. The relief is similarly indicated.

3. Map on the scale of 1 : 2000 of the wintering station. This map, 26 × 21 centimetres (10¼ × 8¼ inches), shows the position of the ship, the situation of the storehouse, the observatory, the meteorological, the magnetic and electricity of the air installations, etc. The relief is shown by contours at 1 metre intervals.

4. Map of the Gnipa cavern on the scale of 1 : 4000; contours at 5 metres (16·4 feet). The map, in consequence of the nature of subject, can only show the surface of the ground and indicate the situation, extent, and breadth of the cave with the relief of its bottom. The cavern being a unique occurrence of peculiar character and of particular glaciological interest, a longitudinal section was drawn, as well as a large number of cross-sections, and photographs were taken.

As the surveys 1 and 2 represented only one of the characteristic landscape forms, namely, the *moutonné*, there was surveyed map—

5. A map on the scale 1 : 50,000 of the plateau country at Pustervig and Mörkefiord. The relief will be shown by hatchings.

Lastly, in order to give a graphical representation of the chief geographical conditions affecting the peculiar bird fauna of the swampy district west of Storm cape, in the summer of 1908 was compiled—

6. An ornithological map of the area mentioned. The map, on the scale of 1 : 25,000, embraces an area of about 15 square miles.

In connection with the cartographical work the following problems had to be solved :—

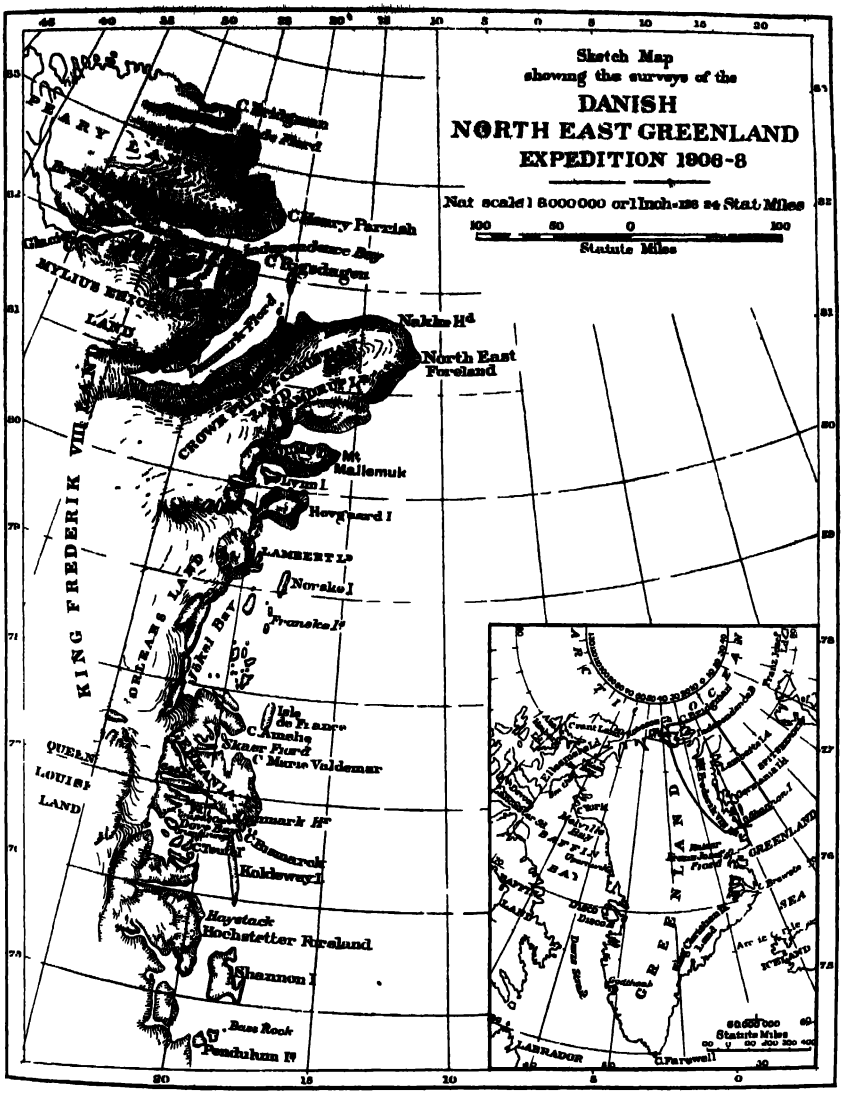
Determination of the geographical co-ordinates of the winter station.

Azimuthal readings for the orientation of the triangulation network.

Determination of the local time.

In September, 1906, the observatory was installed on a granite pile, which was firmly fixed in the ground with cement. On the pile, and securely fastened to it, was an iron plate, on to which the instrument, a Hildebrandt theodolite, with its micrometers, was screwed. Latitude observations were made in the latter part of 1906 by zenith distance measurements of two stars near the meridian on either side of the zenith. When later observations had been taken to determine the sidereal refraction there was material to ascertain the latitude with any desired degree of exactness.

It was intended on a sledge journey in November, 1906, to transfer the time from the Pendulum islands to Danmarkshavn with the aid of three pocket chronometers. The attempt failed owing to the difficult



travelling conditions and the awkwardness of using the chronometers at the very low temperature. As the determination of the longitude by trigonometrical methods in September, 1907, could not be considered reliable, the longitude was obtained from the movements of the moon.

The method of lunar azimuths was adopted, which was well suited both for Arctic conditions and for the instrument of the expedition. Altogether, lunar azimuths were measured twenty-one times, with forty-two corresponding determinations of time whence material was obtained for twenty-six pairs of independent values of longitude. Azimuth observations were made of the polar star at its greatest meridian distance. Almost all the time determinations were transit observations of a polar star, the stars α and λ *ursæ minoris* being used. In summer, of course, the time had to be fixed by zenith distances of the sun.

The astronomers of the *Germania* expedition were led by a regular difference in solar observations for time, morning and afternoon, to the conclusion that the refraction of light in East Greenland must be less than that given in the tables of Bessel and others. To settle this question a series of investigations into sidereal refraction was instituted. The observations took exclusively the form of zenith distances near the meridian for the determination of latitude.

In summer the sun had to be resorted to exclusively. In general, six readings were taken at the upper and lower culmination of each limb of the sun, grouped so that the meridional zenith distances could be conveniently calculated both for the upper and lower limb. In all twenty-eight sets of twelve zenith distances of the sun were taken. In the latter part of 1907, meridional zenith distances—single observations—were made of fifty fixed stars, so grouped that they were distributed at about equal distances on both sides of the zenith. Some of the solar observations were worked out, and as these showed no clear agreement with the tables issued by the *Germania* expedition, a series of experimental solar time determinations was taken morning and afternoon, as well as intermediate determinations at night in the vertical of Polaris. Neither did these observations seem to give results in the direction indicated by the *Germania* expedition.

As terrestrial refraction, both as regards its absolute value and its variations, is of great importance on a geographical exploration, where one cannot always choose time and opportunity for observations, a special series of investigations was instituted with regard to this phenomenon. A scientific determination of periodic refraction constants could not be effected with the means available, but results sufficient for practical purposes might be expected.

From August to October, 1907, reciprocal simultaneous zenith distances were measured five times over the land between the fixed observatory and pillar X., and once over the water between the observatory and a rock. The distances between these points were about $4\frac{1}{2}$ and 6 miles respectively. For the measurements the fixed instrument was used at the observatory, and at the pillar and reef one of the small portable alt-azimuth instruments. In view of the different conditions at the two terminal points, 2×20 readings were taken each time from

pillar X. and from the rock, while the simultaneous observations at the observatory consisted of 2 × 8 readings. The interval between the two groups was about five hours, during which levellings were executed from the observatory to the pillars V., IX., and X., as well as to the reef.

To ascertain the refraction variations a series of levellings was executed in two sets to the pillars V., IX., and X., as well as to the rock mentioned, and to the horizon at three different points. These measurements (in the summer of 1907) were frequently executed at the same time with balloon and kite ascents, or with special meteorological observations at the crow's nest of the ship.

Altogether fifty-three double sets were obtained to the pillars and rock, forty-seven single sets to the three points on the horizon, and thirty special levellings to pillar X. As expected, the levellings proved that the refraction is subject to very considerable variations.

Geologically, the country exhibits great uniformity; the archæan massive extends out to the coast along far the greater part of its extent. There are, however, in some parts high plateaus, as round Mörkefiord and Seal lake around Skærfiord, and also alpine country occurs in Queen Louise's Land, in a limited extent at about 80°, and Peary Land. Sedimentary rocks occur in a very small belt along the coast, and as a rule in fairly undisturbed beds. Late eruptive rocks are not to be found either in association with sedimentary deposits or elsewhere. Large palæological collections were brought home from various sources.

In the southernmost region, Hochstätter's foreland, the fossils were in a bad state of preservation and collection was difficult, for the land at the time of investigation was still covered with snow; but still the material brought home shows that the view hitherto held of the Tertiary age of this formation cannot be maintained. Covered by the lofty bed-rock which forms the western side of the large Koldewey island are found on the east side of the island Jurassic deposits with many well-preserved marine fossils. The beds form a plateau about 390 feet high, overlying gneiss, and are very conspicuous in some fissures out towards the sea. In contact with the Jurassic deposits but not overlying them is found a less extensive, much disturbed, deposit of late Cretaceous rocks.

In the region west of the ship's harbour is a considerable extent of raised sea-bottom, a singularly undulating country, consisting of sand-banks up to a height of 490 feet, which in section was seen to consist of quite loose sandstone, with belts of lime and a very fine seam of coal. At one place were found half-petrified bones of a large whale. The raised bottom was of large extent, and attained a height of some 1600 feet. Bivalve shells were found on this formation up to a height of 800 feet.

In the most northerly part of Germania Land, at the edge of the ice-stream which descends to the south-western point of Glacier (Jökel) bay, a bed containing fossil plants was found in a ravine. The fossils brought home from here were not so well preserved; their age is not yet determined.

By far the largest and most interesting sedimentary deposits occur to the north, between lat. 80° and 81°, where they form grand elevations on the south side of Holms Land and partly along the southern coast of Amdrup's Land. The material collected seems to show from a preliminary examination that these beds must be referred to the Carboniferous system, and in the circumstances of their bedding they bear a close resemblance to the early Carboniferous strata of Spitsbergen.

The coast land is bounded to a great extent by inland ice on the west and ice-covered sea on the east.

The glaciological investigations dealt chiefly with the winter harbour and its immediate surroundings, 76½° to 77°, but were also extended over all north-east Greenland from 75° to 83½°. While a broad coastal zone with prominent elevations occurs at Scoresby sound and Franz Josef's fiord, the ice-free land farther north becomes lower and narrower, and west of Danmarkshavn, where the heights are everywhere less than 3300 feet, the inland ice runs out to the sea in a glacier 12 to 18 miles broad. North of the winter harbour, the ice-free strip becomes still narrower, and from the neighbourhood of Lambert's Land a continuous coastal belt does not exist, but only some patches separated from one another by broad tongues of ice. Yet north of Lambert's Land, between 79½° and 80¾°, occurs a high mountainous land, intersected by numerous fjords, which blocks the course of the inland ice and at the same time has protected the sedimentary rocks lying here from glacial abrasion; but north of 80¾° the land sinks quite down; the coast-line disappears almost entirely under the inland ice. In relation to the small precipitation in north-east Greenland, the ice-mantle may be considered to be very extensive. On the other hand, the mountainous Peary Land, as far as may be judged from Peary's and the *Danmark* expedition's journeys, is almost clear of inland ice.

From the glacier, 25 miles broad, south-west of Lambert's Land, the ice streams out over Glacier bay, between 78° and 79° N. lat., which is covered and almost entirely filled up with a continuous mass of inland ice. Only the south-west corner of the bay is free of inland ice; it is instead full of calved ice from the glaciers, which here reach to the water. Only occasionally do the ice-floes escape from the bay; as a rule, they melt or evaporate away on the spot.

The ice in Glacier bay has most of the features characteristic of the marginal zone of the inland ice—fissures, undulations, reports produced by thawing, just as, also, the structure, stratification, and

surface moraines show that one is really on inland ice; but in other respects this ice exhibits striking peculiarities, due to—

(1) That the ice is for the most part afloat;

(2) That the surrounding sea is always covered with sea-ice.

The results are, firstly, that the crevasses are not very deep, scarcely anywhere more than 115 feet, and that the bottom is horizontal and covered with salt ice; but a far greater effect on the character of the ice is exercised by the great compression caused by the tide. This is due to the same cause as is active where the ice-sheet breaks off from a glacier or at the formation of an ice-foot—the rending and pressure of tidal water in an ice-bound fiord. The result, however, is different, an ice-foot, for instance, being a very rare occurrence.

When the sea outside is free of ice, the ice which breaks loose in the tidal water produces calf ice or icebergs, and is carried away, while the margin of the inland ice stands up like a wall, as is the case far north on the east coast of Greenland, between 80½° and 81½° N. lat., where the open sea is in direct contact with the inland ice, just as occurs in the Antarctic regions; but at Glacier bay sea-ice bars the way and the ice-sheet remains in its place or is crumpled up. In consequence of the movement of the whole ice mass out from the coast, the crushed ice is gradually worn down and at length loses its character. The area of compression thus contains parts within which the ice rests on the bottom and outside which it is floating. Here the under side is attacked by the salt sea-water, thins out, and finally is lost in the sea-ice. The peculiar circumstances thus cause the transition from inland ice to sea-ice to become quite effaced, and in the early part of the year, when the snow-mantle is thick, one may drive half-a-day's journey without being able to decide whether one is on land or sea-ice. Such conditions as in Glacier bay are met with in the broad fjord north of Lambert's Land as well as between Danmarksfiord and Nakke (occiput) head.

South of the north-easterly sweep, on the other hand, where open sea runs right up to the coast, one finds, as already mentioned, an ice-wall about 30 miles long with a height attaining to 50 feet.

In March and May, 1908, two sledge-journeys were undertaken over the inland ice. The goal of these journeys was a mountainous country, 5000 to 6500 feet high, lying about 90 miles west of the expedition's winter haven, Queen Louise Land, which is entirely surrounded by inland ice. Neither of these journeys yielded absolutely new observations on the ice, but yet they contributed in no small degree to our knowledge of the conditions in the marginal zone (the surface and gradient of the ice, distribution of precipitation, snow limit, extent and structure of ground moraines, water-line at *nunataks*, etc.), and the excellent photographs obtained on these two journeys are of more than usual interest.

In the course of the winter huge masses of snow were piled up in the hollows, which the short summer was unable to contend with. Besides large sheets of firn occurring in abundance, in the later part of the year frozen remains of snowdrifts were seen in the valleys, and, especially in the river-beds in the valley bottoms, quite small firn-patches, beneath which the river had made its way and hollowed out the drift. Though the first breach is made by water, the excavation is continued by the circulation of air, and thawing and evaporation can produce caverns of considerable dimensions. The largest of these, the Gnipa cave, was more than 2600 feet long; its height varied from 13 to 65 feet, and its maximum breadth was about 100 feet. Dirty layers alternated with layers of transparent and opaque ice. In the central part where the cave was quite dark, the form was a very regular barrel vaulting, but towards the ends the structure was more variable. The reflection of light from the vaulting, the shining points of the icicles a yard long, and the fantastic forms of the ice lent this section of the cave a romantic beauty.

Besides the map already mentioned, and a complete description of the details, as well as investigations into the circumstances of the cave's formation, the expedition brought home a very large and very good collection of illustrations of the Gnipa cave.

Investigations of the sea were principally executed during the sea-voyages from and to the winter haven between 75° and 78°, but they were continued during the sojourn on land by sledge expeditions to the ice-covered fiords and lakes in which were constantly collected material. The results consisted chiefly of (1) a cross-section of the polar current from the Atlantic ocean-depth (about 1300 fathoms) across the current over the submarine plateau to the coast. In agreement with earlier researches an intermediate layer of warm salt water was found, above it polar water of lower salinity, and a bottom layer of colder and likewise highly saline water. In the middle layer, which was first detected by Ryder and afterwards was the object of a careful investigation by the *Belgica* expedition, with results agreeing well with those of the *Danmark* expedition, was found a temperature of 34·3° and a maximum salinity of 34·97 per mille, while the bottom water showed a constant salinity of 34·88 per mille, and a temperature of about 30°. In contrast to these layers, both originating from the Atlantic, the surface water has a salinity of only 32° per mille. This water forms the southwards-flowing ice-bearing polar current which seems to follow fairly closely the submarine plateau (30 to 220 fathoms deep), over which it has its greatest velocity. The velocity diminishes very quickly out towards the Atlantic depths, and also decreases towards the coast, where deeper water (247 fathoms) often occurs. The distribution of ice in the stream was the old familiar one: an outer zone, with somewhat scattered ice in small pieces, a central zone occupying the greater part of the current, with heavy pack-

ice several years old, and densest at the margins of the belt; and an inner zone of open coast-water with scattered ice, partly detached floes from pack-ice, and partly winter ice from bays and fiords. (2) A series of determinations of the fjord water's salinity and temperature. The water of the upper layer was cold and slightly salt, whereas in the deeper fiords, where the depths were over 800 feet, warmer (32·9°) and salter water (34·85 per mille) was found.

In a lake, lying about 30 feet above the sea, there was found at a depth of about 200 feet a temperature of 35·6°, and a salinity of 28° per mille. This salt bottom-water smelt strongly of sulphuretted hydrogen. The lake had an outlet to the sea by a broad and abundant river; its lower part, about 30 miles from the river head, was full of morainic deposits, the inland ice sending out a small glacier into the lake. Almost all over it floated broken calf-ice. (3) Investigations into the fiord ice, which showed that its conditions were very different in the two winters. About Danmarkshavn the fjord ice in the winter 1906–7 attained an average thickness of about 70 inches. It was hard and compact, and increased considerably in thickness at the beginning of winter and afterwards slowly. The maximum thickness was reached in March, and there was little diminution in April and May. The breaking up of the ice in the summer of 1907 was on the whole very incomplete. In the winter 1907–8 the ice in the same places attained a thickness of only about 47 inches. Early in the season, while the ice was still thin (about 8 inches), a heavy fall of snow caused it to be covered with water, which was turned into less compact, granulated snow-ice. This ice melted completely in the summer of 1908. Besides these measurements, current measurements were taken in various fiords, and a detailed sounding of the sounds at Danmarkshavn was executed.

In continuation of Dr. Krogh's researches in West Greenland* a series of simultaneous determinations of carbonic acid tension were made in the surface water and the atmosphere at the season when the sea was free of ice. Also a large series of carbonic acid observations in the atmosphere were made in different seasons with relation to respiration experiments.

At the ship's harbour continuous series of tidal observations were repeatedly recorded but the results cannot yet be given.

The meteorological investigations consist of the following observations. At the station Danmarkshavn the following instruments were read three times daily (8 a.m., 2 p.m. and 9 p.m.) from August 16, 1906, to July 21, 1908: barometer (mercurial), thermometer, psychrometer, hair hygrometer, and Wild's anemometer; also at 8 a.m. the rain-gauge and the maximum and minimum thermometers (as at Danish meteorological stations). During the whole stay the self-recording instruments for temperature and atmospheric pressure were in operation.

* *Meddelelser om Grönland*, xxvi.

In addition daily readings were recorded in the winter of 1907-08, of the same kinds at the Pustervig station about 37 miles west of the ship's harbour. The object of this latter station was to investigate the climate in the inner fiords as contrasted with the coast climate at Danmarkshavn. Interesting observations resulted both as regards the distribution of precipitation and particularly with respect to the polar föhn. For instance, it may be mentioned that a föhn, which at Pustervig brought the temperature 72° up, made the thermometer at Danmarkshavn rise only 48°. Lastly, at the Pustervig station temperatures were recorded at various heights on the slopes of the Monument mountain (about 2600 feet). These readings have an especial interest when compared with the results of kite ascents at the main station.

At the head station an especial investigation was made into the daily movements of temperature in the lower 100 feet during calm weather. With this object readings were taken once a month every two hours during twenty-four hours, and at various heights from the sea-ice to the crow's nest. The instruments employed were Assmann's aspiration psychrometer, a hair hygrometer, anemometer, and black-bulb thermometer. As a rule there was an inversion of temperature, which in the spring attained the considerable difference of 14°.

For the first time in the history of Arctic exploration kites and captive balloons were employed by the *Danmark* expedition for the systematic investigation of atmospheric conditions in the higher strata of the atmosphere. Altogether kites were sent up ninety-nine times and balloons twenty-six times to an average height of 3163 feet. The maximum height was for kites 10,200 feet, for balloons 8140 feet. The chief results obtained are already published.*

On mirage there is a large number of observations as well as good photographs, while repeated ascents of kites and balloons exhibit the peculiar arrangement of the layers of air which produce this phenomenon. Of other observations in the domain of meteorological optics may be mentioned those of solar halos, of which photographs were likewise brought home.

Observation of cloud forms revealed cloud formations characteristic of these regions, called in the mean time "föhn-clouds." These may be considered as waves of interference in a surface of discontinuity at a height of 4000 to 4200 feet, produced by friction against the high mountain land to the west of the station. Good photographs have also been brought home of cloud forms.

Lastly, material has been collected to illustrate the very sudden and unusually large variations of temperature which the thermograms from Danmarkshavn, and especially from Pustervig, exhibit, and for

* *Meddelelser om Grönland*, xlii. vol. 2, No. 1.

elucidating the polar föhn. Furthermore, there are numerous scattered observations on meteorological phenomena—insolation, depth of snow, and the quantity of snow in the atmosphere during snowstorms, &c., as well as a number of notes during the voyage of the vessel and during sledge journeys.

The proposed investigation into the electricity of the air could only be attacked in the summer of 1907. Once a month observations were made extending over twenty-four hours and dealing with the electrical potential of the air and its conductivity (Gerdien's apparatus). In winter there was necessarily a reduction in the plan of observation, but a certain number of records were obtained. Several short registrations were made of the electric potential (Benndorf's apparatus), the longest of which extended over little more than a month.

Once a month the three magnetic elements—declination, inclination, and horizontal intensity—were determined with a theodolite; the last, however, only till the end of 1907, as the instrument's mirror became useless. The record of declination extends over a year. During the measurements at Germaniahavn an attempt was made to ascertain the secular variation since 1870. Lastly, on sledge journeys a large number of rough determinations of declination were made.

The ethnographical work of the expedition was seriously affected by the loss, during a journey in 1907, of the leader, on whom research in this domain depended. In the latter part of 1906 some preliminary journeys were undertaken with an ethnographical object, so that the field of work was partly known in main outlines, but all the summer of 1907 was lost for systematic work. At the end of the year 1907 the secretary of the expedition (C. B. Thostrup) was deputed to continue Mylius Erichsen's interrupted investigations, and to his energy is due the collection of very considerable material.

As in other branches of inquiry, exact systematic research was confined to a small region, but from sledge journeys collections and notes were also obtained for the whole of the coast-line visited by the expedition. It was found that the country was uninhabited, but numerous remains were left indicating former settlements of Eskimos.

The material brought home consists of a large collection of ethnographical objects (more than twelve hundred), including all kinds of weapons and implements or fragments of them, as well as ornaments and domestic utensils. At 80° 24′ N. lat. was found a large collection, exclusively bone articles, at other places stone implements; no iron was found. It appears that women's boats and kayaks were known, and that sledge-travelling had reached a very high development. Among implements of the chase are salmon spears and bird bolts. Whetstones were scarce; lamps and cooking vessels are made of hard stone.

The kitchen refuse brought home shows that the extinct tribe subsisted on pretty nearly all the kinds of animals living in the country

(*Lepus variabilis*, *Myodes torquatus*, *Canis familiaris*, *Ursus maritimus*, *Rangifer tarandus*, and *Ovibos moschatus*), besides several marine animals (*Balæna mysticetus*, *Trichechus rosmarus*, *Erignathus barbatus*, *Phoca fœtida*, *Monodon monocerus*) and various birds (*Lagopus mutus*, *Anser segetum*, *Larus glaucus*). Of land animals, the musk-ox (*Ovibos moschatus*) seems to have been of great importance.

A quantity of human skeletons and fragments, including eight skulls,* were obtained from some burial-places. In some of these the teeth were worn away almost to the jaw.

In addition there are a large quantity of notes, comprising descriptions of localities and settlements, drawings of settlements, arrangement and measurement of certain ruins as winter houses, tent circles, meat pits, boat stations, graves, etc. A quantity of photographs were also taken.

To judge from the winter houses, it would seem that there must have been three different settlements. Between the first and second a considerable space of time must have intervened; while between the second and third there was a comparatively short interval. In the district round the winter harbour were found thirty-two of the oldest winter houses, twenty of the second period, and only four of the latest. This may indicate that two immigrations took place at a long interval, and that possibly the few most recent houses are the work of a remnant of the last tribe, which, after trying to reach other and better districts, had to make a return journey along the coast, and finally (as various finds point out) perished here. The ice-free land being here of small breadth, the Eskimos could not make annual journeys inland as they do in other districts, though there are traces of something of the kind in the inner parts of Dove bay at the south end of Seal island and at Rype mountain, where there was opportunity to hunt musk-oxen and reindeer, and also for salmon fishing.

If we consider the circumstances of the first case, we find that the earlier settlers were not spread over the long coastal strip, but were collected in groups at the most suitable spots, separated by more or less inaccessible and extremely barren stretches of coast. On Peary Land no ruins were seen and no trace of man, but elsewhere they occurred from Shannon island to C. Glacier, where the conditions rendered human residence possible, relics of a time when Eskimo tribes inhabited the country.

The ornithological booty of the expedition was unexpectedly abundant. After preliminary investigations at the close of the summer of 1906, continuous observations and biological inquiries were made in 1907 and 1908 in a specially selected district (of which a special map

* A large work on Eskimo crania by Prof. F. C. C. Hansen, Copenhagen, and Prof. Fürst, Lund, will soon appear.

on the scale 1 : 25,000 was afterwards drawn up), in which most of the birds existing in the country were found breeding, particular attention being paid to the breeding-places of such little-known species as *Tringa canutus*, *Calidris arenaria*, *Phaleropus fulicarius*, *Larus sabinei*, *Larus eburneus*, *Anser leucopsis*, and *Somateria spectabilis*.

Of all the species here mentioned, the ornithologist brought home an extraordinarily complete set of specimens, not only of full-grown birds, but also of eggs and young in different stages of development. Thus, for example, twenty-four eggs, and at least as many downy chicks, were collected of *Calidris arenaria*; also eggs of *Larus sabinei*, *Larus eburneus*, and *Phaleropus fulicarius*. Moreover, a breeding-place was noted of about thirty pairs of *Tringa canutus*. New for East Greenland was *Fuligula marila*, of which a specimen was brought home. The better-known bird forms are also fully illustrated, both fully developed birds and young ones and eggs; also photographs of flying birds, birds on the nest, and nests with eggs were taken.

The biological notes include exact dates of the arrival and departure of birds, remarks on the life conditions of all the birds, pairing peculiarities, enemies, etc., thorough investigations into the change of plumage of *Lagopus mutus*, etc. In the unfavourable summer of 1907 there was an opportunity of studying the serious inconvenience which the untoward conditions of the ice caused to birds whose breeding is dependent on open water. Besides this systematic work, many observations of ornithological interest were made during the journeys; thus important bird cliffs were noticed at lat. 80° 12′ and 80° 30′, where *Fulmarus glacialis* was observed breeding.

Abundant information has also been obtained regarding the occurrence of land mammals. On such a well-known animal as *Ursus maritimus* scarcely anything new can be said; yet observations on the mating and bringing-forth of the bear may arouse interest. Of *Canis lupus* there is a very full account, notes on its habits and mode of life; five specimens of the animal were obtained. *Canis lagopus* was also the object of a thorough biological investigation as to the shedding of its coat, breeding, and means of subsistence in the dark season.

With regard to *Mustela erminia*, so seldom obtained in Greenland, very full biological information was obtained. The collections were enriched with eight specimens—five in the winter, two in the summer, and one in the intermediate coat. *Lepus glacialis*, owing to its relative frequency and its remarkable fearlessness at most seasons, was an especially easy object of observation. Among other things a large collection of photographs was obtained of the living animals at close quarters. *Myodes torquatus* was a very interesting subject, as with the existence of the lemming was bound up that of several other animal forms. When the unfavourable weather in the winter 1906–7 reduced considerably the number of lemmings, it also produced serious interference

in other forms of animal life. Wherever the expedition travelled numerous traces of *Ovibos moschatus* were found—skeletons, excrements, spoor. The animal itself was seen only in small numbers, chiefly in the northernmost parts, in Danmarkfjord and in Peary Land. *Rangifer tarandus* had also left numerous signs of its former existence in the country, but the living animal was never met with.

With regard to the sea mammals only scattered notes have been collected. One of the most interesting is that *Trichechus rosmarus* kills seals for food. On one occasion a combat was witnessed, and on another occasion large pieces of seal skin and blubber were found in the stomach of a slain walrus.

The insect fauna * in the district round the winter harbour has in the main the same character as that of the southern region of East Greenland, and differs only in containing a small number of species. A peculiarity is that no representation of the order Coleoptera was found, nor do Physopodæ occur in the collection. On the other hand, *Hæmatopinus trichechii*, not known hitherto from East Greenland, was found on a dead walrus.

Two species of wasps (*Praon sp.* and *Nematus sp.*) are new for East Greenland, and the latter has hitherto never been found in Greenland at all. The nests and grubs obtained of the two Greenland humble-bees show that their mode of life here is the same as in more southern places. Flies are represented by fifteen species, besides a couple that cannot be identified, and a large collection of larvæ. One species (*Catabomba grœnlandica*) is new. Almost all the hares shot were infested with fleas, as was found to be the case by the Swedish expedition on the east coast. Hare fleas were reported by O. Fabricius from the west coast, but have not been seen since his time. Of the nine butterflies one species (*Sericoris schultziana*) is new, and also a larva was found which belongs to none of the known species of butterfly. A bug (*Nysius grœnlandica*) was also new for East Greenland.

The collections of the sea fauna proper present great interest, particularly with regard to the contrast between the conditions of animal life in the seas of North and South Greenland. The material has not yet been completely worked up. Of the more interesting discoveries hitherto revealed may be mentioned a feather star (*Antedon prolixa*) with young in many different stages of development, a very valuable addition to the exceedingly scanty material hitherto known.

Botanical collections were chiefly made on the south coast of Germania Land, and particularly in the immediate neighbourhood of the ship's harbour, and on the rocks and small islands south of the harbour. But there is also a small number of plants brought from Peary Land, and a few from the *nunataks* west of Danmarkshavn. The vegetation

* From Dr. N. C. Nielsen's examination of the collection.

was scanty. In all about ninety species of flowering plants were brought home, of which one only (*Alsine rossii*) is new for Greenland. Small collections were also made of mosses, lichens, fungi, and sea algæ, as well as a quantity of plankton, the last during sea voyages. There are, besides, plants in spirits for anatomical investigation.

During the whole sojourn of the expedition in Greenland observations were made of conditions affecting plant life, the depth of the snow, the date of its disappearance, temperature readings in the under layer of snow and the surface of the ground, radiation of heat, evaporation, sprouting time, flowering season, seed nutrition, etc., so that very important biological data have been obtained.

In conclusion, I may mention that on the *Danmark* expedition physiological investigations were instituted on a greater scale than on any preceding Arctic expeditions. In spite of various difficulties a series of respiration experiments was successfully carried out for one individual; altogether there are about 120 experiments recorded. These are partly morning observations spread over the seasons to detect a possible annual variation, partly distributed over the hours of the day with regard to the daily period.

These tests established the frequency of respiration, the total amount of air respired (ventilation), the alveolar tension of carbonic acid, and the carbonic acid given off. A clearly marked annual period was detected with turning points at the end of winter and the end of summer, and characterized by a diminution in the frequency of respiration, and of alveolar carbonic acid tension from winter to summer, while the ventilation and metabolism increased considerably in the same period. The respiration characteristic of the Arctic summer, which showed a very striking similarity to that in a mountain climate, seems to be due to the effect of light.

A series of temperature readings was also taken to investigate the conditions governing the temperature of the body, and a trial was made in the Polar night of the frequently unsuccessful experiment to test the constancy of the daily temperature curve in the peculiar circumstances, when night is turned into day and *vice versâ*. Temperature curves of the inverse type were successfully obtained. Lastly, a number of blood samples were investigated with respect to the number of *Leucocytes* and the causes of their variations.

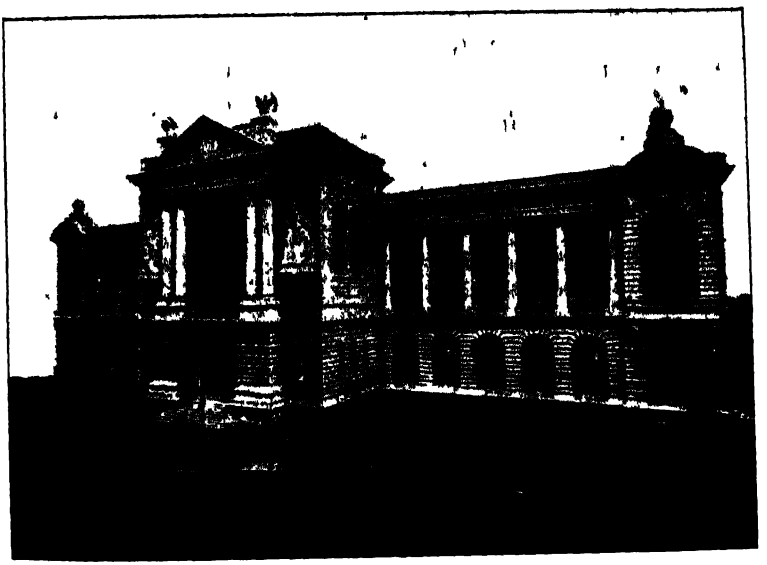
Perhaps it is as well to mention that by all work in which instruments were employed numerous tests were made of the advantages and drawbacks of the instruments under Arctic conditions.

THE OPENING OF THE OCEANOGRAPHICAL MUSEUM AT MONACO.

THE Prince of Monaco, whose pre-eminent position as a practical oceanographer was recently recognized by the Royal Geographical Society, is not content with accumulating data and securing great collections from hitherto unsearched recesses of the ocean. It has long been his ambition to provide for the full utilization of his labours by men of science, and to this end he planned an Oceanographical Institute on a scale of magnitude and completeness such as has never been attempted by any other individual for any branch of science. The scheme includes two parts. The first of these is a School of Oceanography in the University of Paris, the buildings for which are now in course of erection, and the work of which is already being carried on by three professors: M. A. Berget for Physical Oceanography, M. L. Joubin for Biological Oceanography, and Dr. P. Portier for the Physiology of Marine Life. The school will be part of the University, but with an independent organization composed of a French Council and an International Committee on which the oceanographers of all countries are represented. The second branch of the Oceanographical Institute consists of a museum and laboratories at Monaco, the inauguration of which was made the occasion of a great international gathering, including the representatives of scientific societies, and most of the oceanographers of Europe, the accompanying festivities extending from March 29 to April 1.

The museum, which has been built of the local white limestone from the plans of M. Delefortrie, occupies a striking position at the southern extremity of the peninsula of Monaco, near the ancient palace of the Prince and the new cathedral and Anthropological Museum by the side of the beautifully kept gardens of St. Martin. The rocky front of the peninsula drops steeply into deep water, and the museum, which fronts the north, consists of two floors above the level of the summit of the peninsula, and of two, and at one point of three, lower floors looking to the south backed by the rock itself and extending downwards almost to the level of the sea. The ground plan of the two principal floors is simple, but of grand proportions. The building is 328 feet in length, consisting of a central portion 66 feet square, with two wings, each 131 feet long and 49 feet wide. The entrance hall and two great stone staircases occupy the front of the central portion which projects beyond the line of the wings, and leads into an inner Hall of Honour standing 175 feet above the level of the sea. A marble statue by M. D. Puech of the Prince of Monaco standing on the bridge of his yacht occupies the centre of this hall, which is lighted at night by a great pendant in the form of a medusa, the translucent body being illuminated

by numerous incandescent lamps, and four subsidiary lanterns at the corners of the roof are modelled on the pattern of radiolarian shells. Great folding doors open to right and left into halls occupying the wings of the building. The western hall is fitted as a lecture-room, and here the inaugural ceremony on the 29th and the banquet on the 30th took place. The windows are fitted with double blinds, one set white to reduce the glare of the sun, the other set black to darken the hall and admit of the use of the lantern for demonstrations during daylight. A platform runs along the western end, and the whole wall above it is filled by a great oil-painting showing the deep blue surface of the ocean ridged into rollers, with the white form of the Prince's yacht in



THE OCEANOGRAPHICAL MUSEUM, MONACO—FRONT VIEW.

the distance. The walls are decorated in blue, and the panels of the ceiling have pictures of the sea, ships, and marine creatures. The eastern hall is fitted with cases containing part of the collection of marine animals and oceanographical apparatus, and the corresponding hall on the first floor contains the remainder of the collection. The western hall on the first floor is used at present as a preparation room, but will ultimately be available for the exhibition of specimens.

It would take too long to describe, even in a cursory way, the contents of the various rooms. The collection of apparatus for physical oceanography includes historical forms as well as the most recent patterns. The specimens of marine organisms, though mainly the trophies of the Prince's own expeditions, are supplemented from

other sources, and are very clearly labelled in three languages. The nucleus of a most interesting exhibition illustrative of marine industries has also been arranged, and this is capable of great extension, and will appeal to many visitors to whom the scientific exhibits would mean little. Below the ground floor of the building there are two storeys devoted to laboratories, the director's room, workshops, and an aquarium, but these are in no sense basements, for, although the solid rock forms the northern wall, the windows on the southern side open to the air, with a full view of the Mediterranean. The view of the building from the sea shows how ingeniously the architect has not only founded his structure on the rock, but moulded it into the rock, so that when weathered by time it will be difficult to tell exactly where the work of Nature merges into the work of art. The illustration will give some idea of the dignity and grace of the building, the front of which bears the names of many of the ships famous in oceanographical research, such as the *Challenger*, *Talisman*, *Valdivia*, *Hirondelle*, *and Princesse Alice*. The two groups of colossal symbolic statuary above the central doorway are 26 feet in height, and represent on one side Truth unveiling the forces of the world to Science, and on the other Progress coming to the rescue of Humanity.

The museum is in charge of Dr. Richard as Director, aided by a staff of assistants, and a little steamer, the *Eider*, is attached to the institution to serve for collecting in the neighbouring waters, and for affording practical instruction to students in the methods of oceanography.

At the opening ceremony official representatives of several governments were present, including men of such distinction as ex-President Loubet; M. Pichon, the French Foreign Minister; Admiral of the Fleet von Koester, representing the German Emperor; and high officers representing the kings of Italy, Spain, and Portugal. Two French and one Italian torpedo-boat destroyers of the latest type moored in the harbour represented the respective navies. The Institute of France was represented by a number of its most illustrious members, the Academy of the Lincei in Rome, the Academies of Sciences of Berlin, Vienna, and St. Petersburg, and most of the leading Geographical Societies of Europe also sent members to express their sympathy with the inauguration. The British Government sent no representative, nor was any explanation of the omission to be found. We cannot doubt that a misconception of the importance of the occasion must have prevailed in the mind of some official, and that the invitation to participate failed to reach the proper quarter, for no Government in the world has spent so much money on oceanic research as ours, nor has any development of modern science been so distinctly British as oceanography. The absence of any personage of high official or social distinction from this country was painfully conspicuous, and the subject

of much remark and many questions uncomfortable to hear and difficult to answer. British scientific men were there in fair number, and the leading societies dealing with questions relating to oceanography sent delegates. The Royal Society was represented by Mr. J. Y. Buchanan, F.R.S.; the Royal Society of Edinburgh by Dr. H. R. Mill; the Royal Geographical Society by Dr. J. Scott Keltie; the *Challenger* Society by Dr. G. H. Fowler; Mr. W. E. Archer, of the Board of Agriculture and Fisheries, and Prof. W. A. Herdman, F.R.S., of Liverpool, were also there.

At the inauguration ceremony on March 29 the Prince delivered the address, a translation of which appears on another page, and at its conclusion the French Minister for Foreign Affairs, M. Pichon, congratulated him in very cordial terms on the auspicious occasion. Admiral von Koester conveyed the sympathy and appreciation of the German Emperor, and dwelt upon the unique character of the museum. Admiral Grenet conveyed a gracious message from the King of Italy; and Count de Souza-Rosa, in a most eloquent speech, spoke of the intense personal interest taken by the late King of Portugal, himself an ardent oceanographer, in oceanographical research—"One might say that the unfortunate king, jealous of his ancestors who had formerly caused the surface of the oceans to be explored by the valiant Portuguese navigators, had devoted himself to the still more difficult enterprise of exploring the most inaccessible depths;" and the young king had recently dedicated a museum in Lisbon to receive his father's collections. The Senator Odon de Buen conveyed the good wishes of King Alfonso. After the performance of a new cantata entitled "La Nef Triomphale," specially composed by M. Massenet, three short discourses on different aspects of oceanography were given by Professors Berger, Portier, and Joubin. Another new musical production, the "Marche Inaugurale," in which M. Léon Jehin the composer had happily introduced the stirring strains of the Monegasque Hymn, closed the proceedings, surely the most memorable with which any scientific institution had ever been opened.

In the evening there was a special performance of the Monte Carlo Opera Company, in the course of which an "Ode to Thought," specially written by M. Raoul Gunsbourg, was recited by the great French elocutionist, Mme. Bartet.

On March 30, after the banquet in the museum, the Prince proposed the toast of the Heads of States represented at the gathering. M. Emile Loubet, in the name of the Council of the Paris Oceanographical Institute, greeted the Prince of Monaco as a Prince of Science, whose remarkable work was the admiration of the whole world. Prof. Hergesell of Strasburg spoke in the name of the International Committee of the Oceanographical Institute; M. Emile Picard, in the name of all the Academies of Sciences represented, proposed the toast of the new discoveries which would result from the common efforts of men of

science of all nations in the domain in which the Prince continued to explore. M. Massenet, the composer, unable from illness to be present, sent a most eloquent address on the part of the Academy of Fine Arts, in the course of which he said, "That vessel which we see riding in the bay with the deceiving lines of a simple yacht destined for pleasure trips, you have snatched rudely from the calm of these sunny seas and driven towards the frozen oceans of the north, turning the sumptuous ship into a floating laboratory where life is led in serious researches after new truths." M. Périer for the Paris Society of Natural History and M. Gabriel Bertrand for the Pasteur Institute offered their hearty congratulations, and Dr. Scott Keltie, speaking for the Geographical Societies of Europe, expressed the high esteem in which the Prince's work and his successful enterprise in founding this museum was held by all students of geography. M. Girard, in the name of the Maritime League of Portugal, made a speech which concluded with the reading of the following touching message from the King of Portugal:—

"Girard, say to the Prince of Monaco, for whom I have so great a friendship and admiration, that from the bottom of my heart and more than any one else I associate myself with the opening of the Oceanographical Museum. You, better than others, know the reason, so dear and so precious to my heart as a devoted son who can never forget the work of his beloved father."

The other proceedings included various excursions, a magnificent firework display and pageant of the landing of Hercules in the harbour at Monaco, and a demonstration by Lieut. Bourrée, by means of the cinematograph, of the working of oceanographical apparatus on board the *Princesse Alice*, the representation having the illusion of reality to an extraordinary degree. It is the Prince's intention to have every operation of the manipulation of appliances reproduced in this way for use in the lectures at the Oceanographical Institute.

Four committees on scientific work redeemed the occasion from the charge of being a mere pleasure party, and these occupied the attention of oceanographers of all nations. As no report of these meetings has yet been issued, we defer a summary of the conclusions arrived at. The proceedings terminated with a state reception in the gorgeous Palace of Monaco, where the brilliance of the array of naval, military, diplomatic, and official visitors almost swamped the sober garb of the students of science gathered from all lands to hail the inauguration of this great gift to research.

OPENING ADDRESS BY H.S.H. THE PRINCE OF MONACO.

THE ceremony which is taking place in the presence of a distinguished audience is evidence of the progress of a science which, though still young, is firmly established in intellectual life. Now the science of the ocean enters into possession

of this palace on which the architect has impressed the conception of his genius, thus fulfilling my desire of paying the same honour to the two directive forces of civilization—Art and Science. It enters into this palace, where the first echoes that have resounded among its walls and columns have increased the prestige of two leaders in the musical world.

Oceanography now owns fleets to explore the abysms, savants to develop its riches, chairs to educate its teachers and spread abroad its pursuit, and it is liberally supported by many powerful states and some enlightened individuals. Two exalted personages in particular have earned the gratitude of oceanographers. William II., German Emperor, has done much to confer on his country a glory superior to all human forms of ambition, namely, that which owes its life to the atmosphere of laboratories; and he directs his attention chiefly to the sciences connected with the sea. The Emperor extends his interest beyond the limits of his empire, for he has patronized the creation of this monument; has sent forth vessels to investigate the waters of the sea as far as the Indian ocean; has erected on the Peak of Teneriffe, one of the loftiest summits that rise above the waves, an observatory for oceanic meteorology; and, lastly, encourages by marks of his royal favour all, whatever may be their profession, who distinguish themselves by their scientific work.

King Carlos of Portugal devoted the best part of his leisure to the pursuit of oceanography, and he was giving a useful example to the science of his country when a crime, inspired in the lower depths of politics, and which broke in upon the progress of morality, terminated the life of this learned, artistic, and excellent monarch. Thus in our time, disturbed by the collision of an old current of barbarism with the ebullition of the modern spirit, we see wild waves flood fields of human nature which would be already protected if so many ancestral impulses had not rendered them a domain difficult to reclaim. But atavism, this restricted force which carries through successive stages of existence the influence of previous generations, yields but very slowly to a force eternal in the universe, the force of evolution, which draws men on to a future concealed behind the veil of time.

In speaking of science we must congratulate Germany and the Scandinavian countries, where both nation and state have felt that scientific culture contains the secret of civilization, where so many citizens constitute foci of intellectual development, where this culture guides the arrangement of ideas.

On an occasion like the present the audience will certainly recall to mind the memorable British savants who first overcame the prejudice against the possibility of life in the deep waters and carried out the glorious pioneer cruises—Carpenter and Wyville Thomson, John Murray and Buchanan. These recollections lead us to Milne Edwards, who was my master in the science, and Magnaghi, whose work opened the way for marine science in Italy; while oceanography expects from Charcot, Thoulet and de Gerlache, Vinciguerra, Agassiz, Steindacher, Nordenskjöld, Forel, and the noted German oceanographers further contributions to the great work of the illustrious phalanx. I also think of Spain, where, years ago, sailors of the old school taught me navigation, bringing me into such close contact with the sea that the union has become indissoluble. Nor do I forget that the Russians, with Bellingshausen, Kotzebue, and Linz, have, perhaps first, produced studies of the ocean waters which are still of great utility, forerunners of Makarof, who was snatched from the higher ranks of science by one of those wars which the most barbarous instincts of mankind still produce amongst us.

Here, gentlemen, you see that on the territory of Monaco has arisen a proud and inviolable temple dedicated to the new divinity which reigns over the intellect. As for me, I have lent the forces of my brain, of my conscience, and my

sovereignty to the extension of scientific truth on the only ground where the elements of a stable civilisation can mature guaranteed against the inconstancy of human laws.

The analysis of recognized facts on the formation and course of the world, soon made it evident that the ocean had played the chief part in the series of causes and effects to which is due the first appearance of life. Then the investigation of the waters excited the enthusiasm of savants, as well as of the increasing multitude of those who understand the pleasure of knowledge and desire to oppose the brutal army of ignorance.

Oceanography has shown that even the abysses of the sea, far from being uninhabited, as badly informed savants formerly declared, are much more densely populated than the atmosphere, where life occupies a single level. Then it points to the basin of the seas, this natural crucible in which float in solution the elements furnished by the Earth for the formation of organisms, as the cradle of the first living cell. And hence we may believe that we, beings leading a terrestrial life, are refugees escaped from the ocean with the energy distilled in the bosom of the waters which furnishes our bodies with the forces of life and reproduction.

Are we happier under the brightness of the sun than in the phosphorescence of the abysses? in the rarefied and variable medium of the atmosphere than in the still space where centuries have watched the transformations of living substance? If pleasure is measured by the intensity of the sensations yielded by the spectacle of the movements of the universe, assuredly we are favoured; but it may be that true happiness lurks in the abysses where shadows pass in silence indistinctly lighted by phosphorescent gleams, where death succeeds so suddenly to life that the two mysteries are often merged together, and where the cruel notion of annihilation never penetrates.

Oceanography develops rapidly, because in the history of the Earth the present and former *rôle* of the ocean have attractions for all sciences. Accordingly, in view of the proportions of a work which extends from pole to pole over all longitudes, in all depths, and through all times, it has been my wish to combine the intellectual forces of all progressive countries in order to consolidate its foundation and direct its growth.

I have, then, established the institute the first section of which is opened to-day—these galleries, destined for material collected during my scientific life and for similar treasures to be acquired in the future; and the laboratories where I wish that oceanographers may make use of the means gathered together for the furtherance of the science. The other section, which will shortly be opened in Paris, is a centre of instruction situated in the very heart of the university and completely autonomous, whither the youth of the schools already flock to listen to the teachers I have appointed.

A French council, which includes some of the most eminent men, conducts the administration of the whole scheme, but an international committee, including the most prominent oceanographers of all countries, controls its scientific interests. And on the occasion which calls us together to-day, unique in the history of our institute, when all the men who have assisted me in realizing this grand intellectual work join hands, knowing that age may soon arrest my efforts, I express my confidence that the honour and learning of one and all will suffice to continue after my time and in the same spirit the task to which I have conscientiously devoted my life. I wish that this monument may afford a shelter for the labours of savants impartially, and hope that it may never minister to the vanity of any one; and when the last acclamations of this assembly, proclaiming the coming of age of a new science, shall die away behind us, the simplicity which accompanies the birth of the greatest moral forces will take up its abode here for ever.

The consecration given by you to my scientific career overwhelms me with joy, for it proves to me that I have not led by an uncertain path the toilers who have followed me, but have been able with their co-operation to increase a little the light which guides us in the progress of the dignity of humanity.

I also desire to express my gratitude to the official missions, to the delegates of scientific bodies, to the illustrious men come hither from all parts of Europe to do homage to a new branch of modern science, the power which transforms the conditions of life, the mental attitude of men, and the relations of nations. And while I experience a feeling of victory at this spectacle of an intellectual cohesion full of encouragement in the midst of the aimless agitations of the world; while I see promises of peacefulness in the more and more active participation of states in the festivals of art and science, I am moved to the bottom of my heart at seeing here the delegates of the Institute of France. For this association, the purest emanation of French genius, has for twenty years followed and supported my labours, and I regard it as the inspirer of my working career. When I let my eyes rove among the ranks of my auditors, I find everywhere some memory that appeals to my mind or my heart.

Lastly, I would testify my affectionate esteem to the group of workmen who represent the builders of this edifice. During the eleven years their task has lasted they have never disgraced themselves, no disagreement has cast a shadow over their workshop. In spite of the tempest which dashes so many brains defenceless against the wild instigations arising from the gaps in an imperfect civilization, their prudence has not given way. Therefore, to-day, in an hour of legitimate pride, I would not only recognize the merit their energy deserves, but also express the feeling we experience of the moral grandeur of the work accomplished.

Gentlemen, I open the Oceanographical Museum of Monaco in order to hand it over to the servants of scientific truth. In it they will find quiet, independence, and the emulation which fertilizes thought. When their thoughts wander from this monument over the blue waters which veil the mystery of our origin, they can sweep all round the world, coming in contact with organisms which hand down to us the story of the ages. When they skirt the flank of our mountains, or rest in their caverns, or in the midst of remains of dead generations, they can plunge into dreams called forth by the history of the Earth. And if they mount to the summits which dominate all the horizon, they will easily reach the recesses of the universe, there to lose themselves in the secret of our destiny.

THE ROYAL COMMISSION ON CANALS AND WATERWAYS.

This Commission was appointed on March 5, 1906, to inquire into the Canals and Inland Navigations of the United Kingdom and to Report on—

(1) Their present condition and financial position.

(2) The causes which have operated to prevent the carrying out of improvements by private enterprise, and whether such causes are removable by legislation.

(3) Facilities, improvements, and extensions desirable in order to complete a system of through communication by water between centres of commercial, industrial, or agricultural importance, and between such centres and the sea.

(4) The prospect of benefit to the trade of the country compatible with a reasonable return on the probable cost; and

(5) The expediency of canals being made or acquired by public bodies or trusts, and the methods by which funds for the purpose could be obtained and secured, and what should be the system of control and management of such bodies or trusts.

Four Reports have been issued, embodied in seven volumes. Vol. 7—the fourth and final Report on England, Wales, and Scotland—contains a discussion of the evidence of the 266 witnesses examined and the conclusions of the Commissioners.

Part I. is an "Historical Sketch," and contains much interesting information. The first canal constructed in the United Kingdom, as distinct from a canalized river, was the Bridgewater canal, from Worsley to Manchester, opened July 17, 1761, and the greatest part of the existing system had been completed by the end of the eighteenth century. The flourishing period for inland waterways came to an end as the railway era advanced, and the position of the canals as to total traffic has been at best stationary between the middle of the nineteenth century and the present time, while the transport business of the country has multiplied several times.

The total mileage of canals and navigations at present used in the United Kingdom is given as about 4670 miles—3639 in England and Wales, 183 in Scotland, and 848 in Ireland; 3310 are neither railway owned nor controlled, and 1360 are so owned or controlled. It is shown that the canals in this country were constructed upon no general scheme or system. As a result of this, while it is possible for a canal boat to go from London to the Mersey or from the Severn to the Humber, the line of waterways is controlled by such a multiplicity of authorities that there is an absence of uniformity in width, depth, in general conditions and in the dimensions of the locks and bridges. An obstacle to through trade therefore exists, similar to that which at one time existed through the difference of gauges in railway lines.

In Parts II. and III. the Commissioners consider the present condition and financial position, and tables are given comparing the years 1888, 1898, and 1905. It appears from these that the tonnage conveyed by those waterways of which statistics are available was, in 1888, 35,301,857 for the United Kingdom, and in 1905, 34,136,767, thus showing a practically stationary condition. It is apprehended by the Commissioners that under present circumstances capital engaged in manufacturing certain classes of goods in the Midlands may gradually migrate to the coast, or even that the process might take the form of the closing down of works. If, on the other hand, through increased cheapness in moving materials, the Midland industries can be maintained or expanded, the railway companies must also gain, as they would retain the passenger traffic and a large share of goods traffic of a certain class.

Four main routes have been selected by the Commissioners which should under any policy of improvement be treated as "great highways traversing Central England." These form what is popularly called the "Cross," and connect the Birmingham and Midland district with the estuaries of the Thames, Mersey, Severn, and Humber. After a careful review of the continental waterways and a consideration of the conditions in England as compared with those in France, Belgium, and Germany, the Commissioners conclude that it would not be practicable to follow the continental lines too closely, and that so large a standard of dimensions as that which has been adopted in Germany, North Belgium, or even on French canals would not be suitable here.

In dealing with the question of water-supply in Part X., it is of interest to note that the investigations of the Commission have shown "the necessity, if the canal system of the country is to be improved and extended in the future, of an authority which would have power to collect and tabulate information regarding the flows of rivers and streams and as to the water supplies available in districts where inland waterways now exist." The difficulties of investigation were greatly enhanced by the absence of statistical information as to the flows of rivers and streams. The Commissioners conclude that the improvement of the main routes of waterways and of the branches and feeders would be of great benefit to the trade of the country. Opinion was divided as to whether or not the traffic would give an adequate direct return on the necessary capital outlay.

"The Commissioners have realized more and more as their inquiry has proceeded, how hopeless it would be to expect anything from the waterway system of England and Wales in the future for the benefit of trade and industry if the waterways were left in their present disunited and unimproved condition."

The most urgent part of the recommendations is that a Waterway Board should be appointed, consisting of three or five Commissioners paid and giving their whole time to the work, their duty to be to review the whole situation, and on being satisfied that either the acquisition or unification or in addition the reconstruction and improvement of certain waterways would be desirable, they should propose a scheme for the sanction of Parliament, and should have power, with the approval of the Treasury, to issue stock or raise loans guaranteed by the State to obtain the capital required.

It is indicated that the work of carrying the entire scheme for improvement into effect should be gradual, each stage being preceded by a careful estimate of the cost and prospects of traffic returns. While State aid is recommended, it is added that, "It would be necessary to ascertain, as regards each successive measure of improvement which the Waterway Board take up, as to what extent assistance would be rendered by at least some of the localities and interests that would receive benefit."

The acquisition of any British waterways of importance now in the hands of railway companies is advised as an early part of the scheme. Whether the collection of information as to the flows of rivers and streams should be entrusted to the Waterway Board is recommended as "worthy of careful consideration."

The recommendations in this Report do not refer to Ireland, as a separate Report will be issued on the Irish canals and waterways. In Part XIV. the Scotch waterways are dealt with. The project for constructing a ship canal between the estuaries of the Forth and Clyde is considered. The Commissioners obtained the views of the Board of Admiralty and the Committee of Imperial Defence on this, and the conclusions of the Committee show that, while a ship canal constructed to meet the requirements of the Admiralty "would unquestionably possess some strategical value," this would not be sufficient to warrant any considerable expenditure from Government funds, or a State guarantee of interest on the total estimated cost of construction; but that some Government aid would be obtainable towards a commercial canal of the required dimensions if it followed the route through Lochs Lomond and Long.

As to the Caledonian canal, the Commissioners recommend that the Government should take into consideration the advisability of making further grants for works of improvement.

It is stated that a strong case has been made out for improved communication across the Mull of Kintyre, with only two locks at the two entrances. The Commissioners would not attempt to decide between the rival projects laid before them of the improvement of the Crinan canal and the construction of a canal at Tarbert.

Broadly speaking, the Commission favours a policy of unification and improvement, the details of which must be left to the proposed Waterway Board. The Majority Report is signed by sixteen of the nineteen Commissioners, but with reservations in five cases.

J. S. O.

SOME RECENT CHANGES IN THE COURSE OF THE TRENT.*

By BERNARD SMITH, M.A., F.G.S.

ATTENTION having been drawn, during the last two or three years, to certain changes which were said to have taken place in the course of the Trent within the historical period, I was led to consider whether other changes had been put on record, and how far they agreed with geological and other evidence. The results of my investigations are embodied in the following somewhat inadequate account of that part of the Trent between Nottingham and Gainsborough. The district most minutely described, because best known to me, lies between Newark and Dunham

* With the permission of the Director of the Geological Survey. Research Department, December 16, 1909.

Bridge 12 miles to the north, in Sheet 113, 1 inch Ordnance Survey Map; beyond these limits only one or two isolated and striking examples are mentioned.

The Ancient Trent.

In late Glacial times, waters, probably impounded by an icy barrier, escaped over a col or wind-gap at Lincoln and deposited the gravels capping the highest hills between Newark and that city. The gap was lowered, and a second series of gravels distributed on gently inclined slopes of the solid rocks and in hollows scoured through the older gravels. Such gravels occur near Nottingham, Radcliffe, Farndon, and Newark. From the latter place they stretch to Winthorpe and Langford, and thence in a well-defined S-shaped belt to within 1½ miles of Lincoln. The waters again rapidly fell * almost to the level of the Trent valley, and then escaped by two exits: the Humber and the Lincoln gap. Gravels thus accumulated not only occupy the present valley floor, but spread widely over the ground to the east, abut against the well-marked terrace of the second series near Langford and Eagle, and sweep round the northern flank of the Doddington hills to Lincoln.

The scanty evidence at our disposal tends to show that all these deposits were formed after the retreat of the ice, for although they rest upon boulder clay at several points, they are never found beneath it.†

Again, the valley floor between Nottingham and Newark is post-Glacial, because no drift has been found beneath the river deposits.‡ The river had, however, established its present course before the close of the Pleistocene period, because the bones of extinct mammalia § have been found in the valley deposits above Nottingham. At such a time heavy floods would occur on the melting of ice and snow, and the river and its feeders would be larger and more powerful than the present stream, which cannot lift and spread gravel over its flood-plain. The stream was choked with *débris*, and compelled to split into rapidly changing branches which spread the gravels far and wide.

Since their accumulation the inequalities of surface have been partly levelled up by deposits of fine sediment brought down by the side streams.

The Trent of To-day.

The surface of the present river is at a slightly lower level than that of the latest gravels. At ordinary times it rearranges the mixed sand and gravel, depositing the sand above the gravel, and placing a layer of fine loam, derived mainly from Triassic rocks, upon the top of all. Thus the alluvial plain within the old gravel plain is built up both by lateral movement or planation, and by floods which level up the surface.

Evidence for Changes.

The conclusions arrived at as to recent changes in the river's course are based upon evidence of the following kinds:—

(1) Geological—noted on the ground.
(2) Historical and documentary.
(3) Old maps and plans.
(4) The flood-banks.
(5) Reports from living witnesses.

---

* Probably when the Marlstone of the Lincoln cliff was cut through.

† "The Geology of the Country around Lincoln," *Mem. Geol. Surv.* (1888), p. 145.

‡ "The Geology of the Country between Newark and Nottingham," *Mem. Geol. Surv.* (1908), p. 73.

§ *Ibid.*

Navigation and Floods.

Villages of Danish and Saxon origin are situated upon both banks of the Trent, which from very early times has been a means of communication and a highway.

The Foss dyke, west of Lincoln, follows the course of the old Carr dyke, a Roman work connecting the Lincolnshire fens with the Trent near Torksey. Gates of some kind were without doubt erected by the Romans to prevent the waters from reaching Lincoln by way of the Carr dyke, for in the past every flood must have taken this route to the sea. It is also probable that the five low gaps on the east of the Trent valley—at Marton, Torksey, Foss Dyke, Newton, and Spaldford—were embanked by the Romans;* the banks are at any rate of very ancient date. The southern, Spaldford "Wath bank" is most dangerous, because the fall from it to Lincoln is greatest. In February, 1795, it burst,† owing to a thaw following two months of frost and snow, and the flood covered 20,000 acres west of Lincoln. The bank has often been in peril when floods have inundated the Trent valley.

Domesday Book records that the water of Trent was kept so that if any should hinder the passage of boats he should make amends. Henry I. gave the Bishop of Lincoln permission to erect a bridge at Newark, "so that it may not hurt my city of Lincoln nor my borough of Nottingham."‡

Acts of Parliament relating to the navigation were passed between 1699 and 1794, and troubles about weirs arose as early as 1292. These and other instances mentioned later show that importance was attached to the control of the waters from fairly ancient times.

Changes in the Course due to Invasion of the Gravel-plain.

Changes involving more than mere straightening by cutting across a loop have in some cases been determined by the peculiar conditions of surface of the latest valley gravels between the recent alluvium and the old valley wall. These flats are traversed by a drainage system consisting of hill-streams and of becks, which often rise near the river, flow away from or parallel to it, and finally make junction down-stream. Should the heads or loops of any of their shallow trenches be near a point where the river in flood is likely to overleap its bank (*e.g.* the outer curve of a meander), the conditions favour a change of course: the flood pouring into the shallow groove would be concentrated and cut away the strip of gravel between the old and new path.

Had not timely repairs been made to the bank south of Rolleston in 1905, the Trent would have accomplished this feat and swept down the course of the Rundell dyke past Rolleston and Staythorpe.

Rastall,§ quoting from an autograph of Thomas Heron, of Newark, says, "Where the main stream now runs by Kelham, there was a small brook which not being sufficient for the various purposes of the Sutton family resident there, a cut was made from the Trent to the brook which gave a turn to the whole current, . . . it then forced its way and formed that channel which is now seen. There were carriage bridges over the brook, at Kelham and Muskham, . . . and they were obliged to build bridges over the new and extended river." This probably happened previous to 1225, for tolls were then collected at Kelham bridge.‖

---

* J. S. Padley, 'The Fens and Floods of Mid-Lincolnshire' (1882), pp. 1, 2

† *Ibid.*, pp 2, 3, and Map. The effects are still visible.

‡ 'Vict County History of Nottingham,' p 238.

§ Rastall (William Dickinson), 'History of the Antiquities of Newark' (1805), p 45

‖ Nottingham Borough Records, 1225, November 17.

In 1347 (Patent Roll, 20 Edw. III.) John de Sutton of Averham and others made cuts and pulled up piles to the detriment of the Newark millers.

At Kelham the strip of recent alluvium is no wider than the river itself.

As chronicled by Dickinson and Throsby, Holme was a hamlet attached to the parish of North Muskham, until the Trent, during a high flood in A.D. 1600, separated the two places; but Saxton's map, published about 1576, shows Holme already cut off. A will of Stephen Surflett,* of the same date, leaves land for the maintenance of the water-bank at Holme; it is therefore probable that the change took place in Surflett's lifetime. The alluvium between Holme and Muskham is thrice the width of the stream (Fig. 1); but whereas the Kelham cut was nearly straight, that at Holme must have followed a winding course. Subsequent movement of the meanders would account for the greater width of the alluvial strip. Last century an old man at Holme remembered a barge sinking in the river on a spot now an orchard 100 yards from the stream.†

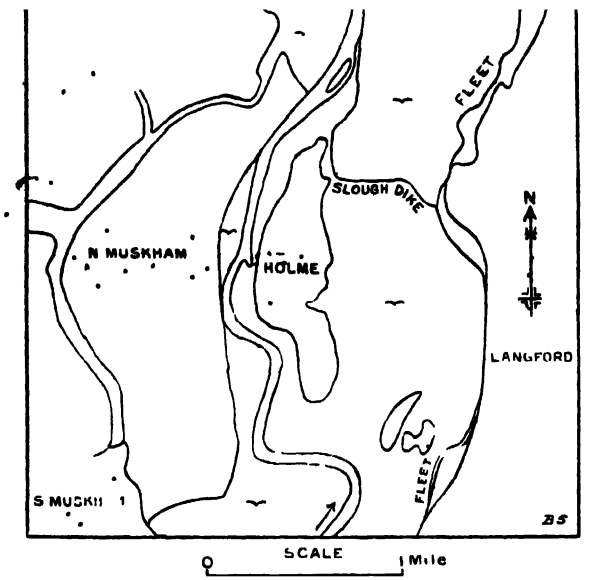


FIG 1.—THE TRENT SEPARATING HOLME FROM NORTH MUSKHAM. THE STIPPLED AREAS ARE GRAVEL. SCALE 1 INCH = 1 MILE.

Changes on the Recent Alluvium.

The Nottingham Borough Records for 1392 give an account—after Royal Commissions in 1378 and 1383—of a "Process against the Lord of Colwick for obstructing the course of the Trent," the substance of which is, that William de Colwick, Knight, and others, have diverted the waters of Trent from its ancient course into a trench by which a portion of the said water formerly held its course, by planting obstructions. The water totally left its former course and ran to the mill in Over Colwick, where a closed "wear" was made. The former course, about

* My thanks are due to Mr T. M. Blagg, Little Carlton, Mr E L Guildford, Nottingham; Mr. A. E Frost, Kelham; and others for suggestions and references.

† E G. Wake, M.D., 'The History of Collingham' (1867), p 95

1¾ miles in length, between the vil of Adbolton and the vil of Over Colwick, was destroyed and filled up so that ships could not come to Nottingham for nine years. The former course is the Old Trent now defining parts of the boundaries of Colwick and the Borough of Nottingham.

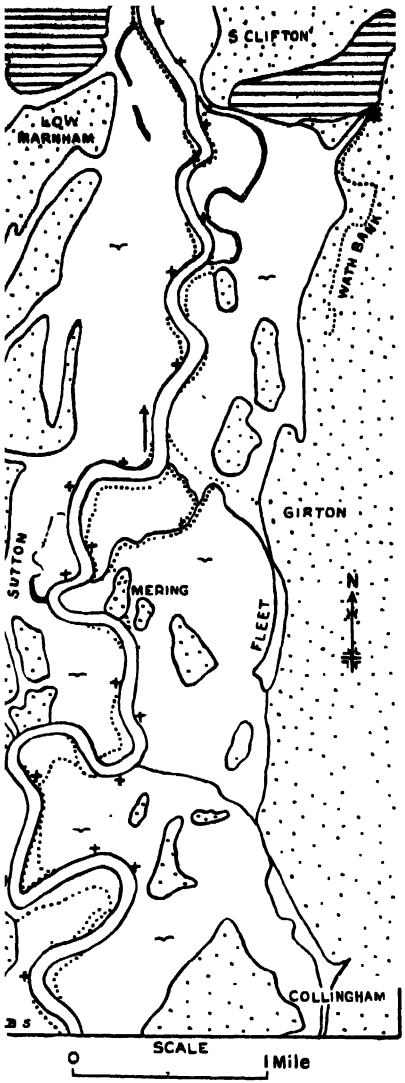


FIG. 2.—MAP OF THE TRENT VALLEY BETWEEN SOUTH COLLINGHAM AND SOUTH CLIFTON, SHOWING OLD COURSES AND THE BANKS (DOTTED) WHICH ARE NOT ACTUALLY AT THE WATER'S EDGE. CROSSES INDICATE POINTS WHERE CORRASION IS PROCEEDING; THE STAR WHERE THE BANK BURST IN 1795. SHADED AREAS ARE KEUPER MARLS; GRAVELS ARE STIPPLED. SCALE 1 INCH = 1 MILE.

Instead of passing Kelham, as at present, the Trent, or a branch of it, formerly passed Newark some 345 yards distant from the Castle and joined the Devon below the town. This Old Trent, now a mere trickle in a narrow winding valley, separates the hundred of Newark from that of Thurgarton. Above Newark an artificial cut connects the Old Trent with the Devon, which, after flowing beneath the Castle, joins the Trent at Crankley's point 1½ miles downstream. The arrangement is shown in an old map of 1558, in Brown's 'History of Newark.'

Further north the stream has, at some unrecorded * date, cut off a field from Carlton parish, and although separated from it by the river, the villagers still exercise their right of pasturing cattle thereon. This field, Carlton Holme, by its uneven surface has the appearance of being formed by lateral movement of the river; the old flood-bank may have fixed the parish boundary.

Between Sutton on the left bank and the Meering, an island is shown on Saxton's map of 1576, and on others down to Harrison's of 1792. The eastern channel has silted up, and old meanders are visible upon the site of the island (Fig. 2).

Sutton South Holme was an island in 1834; † a part of the western stream course still exists as a long pool. The river evidently bifurcated by pouring sideways, from the outer curve of a meander, into the channel of a stream draining the alluvium. The entrance to the backwater points downstream, probably because the meander has

* E. G. Wake, M.D., 'The History of Collingham' (1867), p. 38

† Map published in 1834 by G. Sanderson, Mansfield.

moved in that direction. This also happened at Dunham island referred to later.

Across the river, and belonging to Sutton, is Smithy marsh, a pasture some 120 acres in extent. A bank, ditch, and the parish boundary on the east fix the site of the old Trent which changed its course before the date of Saxton's map.

South of Clifton hill, east of the Trent, an old meandering course, more than a mile long, cuts off a piece of ground known as "The Ropes." This old course is probably of great antiquity, because it was the boundary of four parishes:* it is

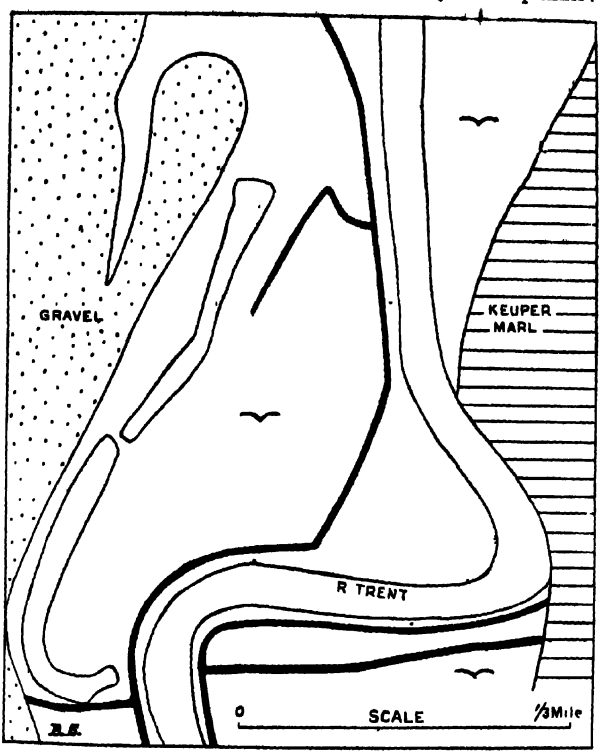


FIG. 3.—THE ISLAND SOUTH OF DUNHAM BRIDGE. THE MEANDER HAS MOVED DOWNSTREAM AND CUT OFF THE BACKWATER.

now narrowing and filling up, but maps from 1794–1834 depict it as half the width of the Trent.

On Marnham Holme, Fledborough Holme,† and under Newton Cliff, stretches of water, choked with silt and water-plants, represent other courses.

The island south of Dunham bridge, shown on maps from 1794–1834, was shaped like an inverted Welsh harp. The river invaded a neighbouring drainage-channel at the turn of a meander which has since progressed downstream, as shown by the new towpath bank (Fig. 3).

* Marnham, Girton, South Clifton, and Spaldford. It is still a parish boundary through half its course.

† Horns of red deer were found at 25 feet (C. Fox-Strangways, *Q.J.G.S.*, vol. 44, p. 158; and *Geologist*, vol. 4).

The Fleet Stream.

Between Langford and Girton there is a low westerly-facing cliff of gravel and sand, beneath which the Fleet stream flows from Winthorpe to join the Trent near Girton. The relations between the cliff and alluvial plain make it clear that the Trent has worked along different parts of it at one time or another; there are, in fact, expansions of the Fleet at Langford, Beesthorpe, and Girton, and formerly at Collingham, which must be regarded as relics of the old Trent. The most important is the Fleet mere, between Beesthorpe and Girton; once a full mile long, it is still a picturesque lake as wide as the Trent itself, and two-thirds of a mile from end to end (Fig. 2).

Movement of the Trent from East to West.

Before separating Holme and Muskham, the Trent probably followed the line of the Fleet at Langford and the Slough dike (a parish boundary), which enters the river at the Roman bridge lately discovered near Cromwell. At some previous date it flowed past North and South Collingham, where two long pools have been recently drained; and the Fleet mere is undoubtedly a part of the old river. North of Girton some low gravel islands are so closely connected as to preclude the possibility of the river having passed through them except at their northern end near the Wath Bank.

Whether the Trent flowed beneath the whole length of the gravel cliff at the same time is an open question.

Wake and others assume that the floods are efforts of the Trent to regain its old channel, now occupied by the Fleet. They point out that the hundred of Thurgarton on the west is separated from that of Newark, not by the Trent, but by the Fleet, and conclude that the Trent followed this course in King Alfred's days.

The river has certainly moved from the east to the west, and is still doing so. On its right is a well-dissected gravel plain; on its left an unbroken sheet, upon which it tends to encroach.

It first left the Wath Bank at some date before 900 A.D. (according to Wake), when the hundreds were defined; deserted the Fleet mere between the tenth and sixteenth centuries; and lastly separated Holme and Muskham. There were probably intermediate stages when the river cut through from North Collingham to Carlton Rack, and when the Kelham parish boundary was crossed.

Thus the old story is repeated. The ancient Trent flowed directly from Newark to Lincoln; then some of the waters fell away to the west to find exit by the Humber. Now the river flows in a northerly direction, but is edging to the western side of its valley—an effect probably due to freer egress through the remarkably narrow gap between the Keuper hills of Marnham and South Clifton, which would tend to shorten and straighten the course as far south as Kelham and Averham.

Lateral Movements.

Abandoned meanders and dying pools occur in such numbers that the conclusion is forced upon us that without embankments or drainage the valley would rapidly revert to a state very similar to parts of the Mississippi valley, where anastomosing channels and ponds occur in unusual numbers.*

These channels were mostly formed within the loops of meanders during the process of planation. My colleague, Mr. W. B. Wright, mapped at least twelve hollows or dry channels on one square mile near Burton Joyce. I myself have

* See Pl. 52, 'Interpretation of Topographic Maps.' Salisbury & Atwood. 1908.

frequently noted them on the large Holmes below Newark. They are now being formed at Smithy marsh, and near Collingham wharfe and Carlton ferry, where the river may in the future straighten its course as it did at Bole and Burton near Gainsborough.

The "Smug and silver Trent" was well known to Shakespeare, for Hotspur—*King Henry IV.*, Pt. I.—proposes to cut through the neck of the Burton loop or "Round." By 1790 the loop had almost closed, and in February, 1792, the Bole round was breached by the river (possibly aided by the bore or "ægir")—an event celebrated three years later by a Mr. Gurnill of Gainsborough, who published a map showing that the other loop would soon suffer the same fate (Fig. 4). White's Directory of Nottinghamshire for 1832 states that "Until 1797 the Trent here (Burton) took such a circular sweep that a boatman might have thrown his hat on shore and after sailing 2 miles have taken it up again, but in that year the stream

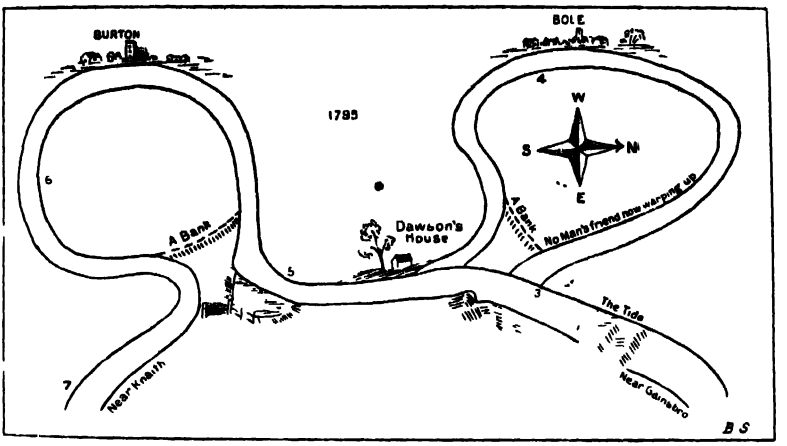


FIG. 4.—BURTON AND BOLE ROUNDS, AFTER A MAP BY MR. GURNILL, SENR. GAINSBOROUGH, 1795.

forced itself through the narrow neck of land in a straight line, in consequence of which the old winding channel was filled up and divided betwixt the counties of Nottingham and Lincoln, besides which the latter had now about one hundred acres on the west side of the course of the present river." Both rounds have recently been transferred to Nottinghamshire, and remain as swampy hollows in Burton and Bole parishes, whose boundaries they partly define (Fig. 5).

About a mile north of Newark, near the Crankleys, an old loop of the Trent forms an ox-bow lake. This loop appears as a right-angled bend in a map of 1646 (revised and published in 1725), drawn by the chief engineer of the Scottish army besieging Newark; and again in Chapman's map of 1774. In 1861 the Great Northern Railway was carried across the then well-developed loop, and to facilitate operations, the bridge was first built upon the neck of the loop, and the river diverted to a new channel cut across the neck beneath the bridge. Human remains, described by Huxley as Neolithic, as well as antlers of red deer, bones of ox and horse, were found beneath the bridge at a depth of 25 feet.* Other evidences of

* *The Geologist*, vol. 4, 1861, pp. 246, 349, 415, 495.

recent lateral movement are numerous; the example at Holme, given above, is a case in point. Roman pottery occurs in the gravels on the west bank above the Roman bridge, where the river runs straight, and a block of dressed lias stone was recently found here in excavations for a lock, at least 25 feet from the bank.

Again in A.D. 1649 * a field—situated beyond the Trent, but in Collingham parish—once of 35 acres, had been reduced to 8 acres by encroachment.

The Flood-banks.

The most striking evidence of planation is furnished by the flood-banks, although the age of many of them is obscure. Some are as old as, or older than, the parish boundaries they define, others are comparatively recent.

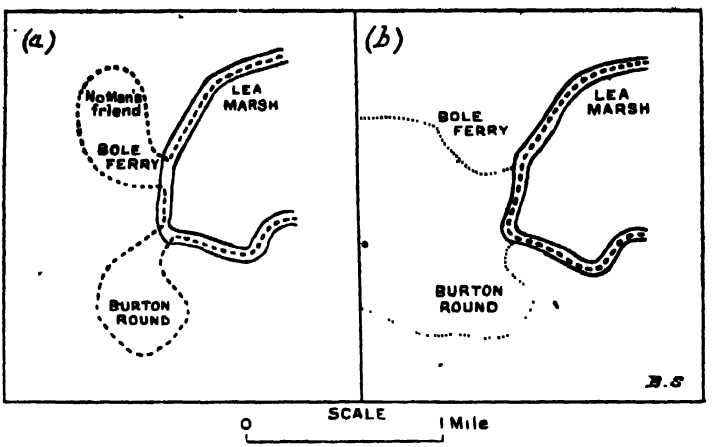


FIG. 5.—THE TRENT AND THE ABANDONED ROUNDS WHICH HAVE BEEN TRANSFERRED FROM LINCOLNSHIRE TO NOTTINGHAMSHIRE. (*a*) ORDNANCE MAP OF 1824. (*b*) ORDNANCE MAP OF 1898. SCALE 1 INCH = 1 MILE.

The Trent is supposed to be a tamed river. Its banks are fortified by flood-banks, piles, stones, cement, and even sunken barges; yet it still persists in meandering. As fast as it undermines the flood-bank, the latter is repaired from the outside, hence the river, so to speak, pushes the outer flood-bank before it where vigorously corrading, but leaves the inner bank isolated by deposit of sediment. A second inner bank then becomes necessary to carry the towpath. †

These deserted banks and new towpath-banks between Collingham and S. Clifton have been plotted on the map (Fig. 2), which shows clearly the movement of the meanders.

Since the Dunham island was formed, the meander, in moving downstream, has deposited at least 15 acres of sediment.

Interference with the River.

If the natural swing of the river is tampered with, it retaliates by readjusting its course below the point of interference. A single case will point the moral.

* Wake, 'History of Collingham,' p. 38.

† According to Mr. F. Rayner, of the Trent Navigation Company, the towpath was made somewhere about 1783.

A breakwater was built upon the eastern bank above Kelham bridge about nine years ago to protect the Newark-Kelham road. The river then attacked the road a little further downstream. Repairs were made last year, and the bank was protected by stakes, cement, and sunken barges, with the result that the main flood is thrown into the eastern span of the bridge, and is rapidly clearing away a large stretch of gravel and loam which had accumulated below. The opposite bank has entirely altered; shallows appear where none were before, and deep holes take the place of shoals; the movement is in fact felt a great way downstream.

The following is a list of some of the maps showing the Trent in Nottinghamshire: 1576, Saxton; 1646, chief engineer Scots army, copied and revised by S. Buck, 1725; 1670, Blome; 1676, Thoroton; 1695, Morden; 1727, Moll's English Atlas; 1744, J. Jefferys, Junr.; 1744, J. Chapman (1st Edit.); 1777, Emm. Brown; 1792, J. Harrison; 1794, Cary; between 1792 and 1797, J. Chapman (2nd Edit.); 1795, Gurnill (Burton and Bole rounds); 1801, C. Smith; 1813, Arrowsmith; 1824, Ordnance Survey; 1834, Saunderson; recent Ordnance maps.

Mr. G. W. Lamplugh: Mr. Smith has shown very clearly that changes have constantly taken place throughout historical times in the course of the Trent; but to any one who knows the structural conditions and past history of the valley, it is really surprising that the changes of the river have not been even greater. Indeed, that the stream should have maintained so nearly its present course during historic times is good evidence for the interference of man from an early period. The river flows along a wide valley with a flat floor built up from the overburden of material brought down by ancient floods, and the present stream is inadequate to remove this material. Upon this flat floor the Trent, under natural conditions, would be likely to shift its branching channels every season, or even many times in a season, as we know to be the habit of uncultured streams of this type in the unsettled parts of the world; but it is not allowed to do so. We see plenty of evidence that it once had this habit, in examining the old alluvial deposits of the Trent. Man came, and found it inconvenient to have an untamed river, so he set about to tame it; and now it affords a good example of the effect of civilization upon a stream.

The travelling downstream of the meanders is of course what takes place in every river of this type; and it would be very interesting if the rate of travel could be definitely ascertained. But I understand that there is doubt in some cases whether the old flood-banks were erected originally close to the river-brink, and where this doubt exists it may not be quite safe to calculate from the present relative position of the bank. Still, as to the truth of the principle on which the argument is based there can be no doubt.

Mr. W. Whitaker: I know very little of this particular piece of country, but some of the points that Mr. Smith made might be applied to other rivers, as to the Thames. A parish-boundary sometimes crossed the river, and the county-boundary did not. This gave rise to an important law case between Middlesex and Surrey. There was another point which interested me, the gradual swaying of the river from one side of its valley to the other. We have a very remarkable case of that in one of the notable Thames tributaries, the Lea. That river has gone from west to east, and apparently it has done this far longer than in the case mentioned in the paper, because at present the river has gone so far to the east that it has cut off nearly all signs of presence on that side of the valley at a much earlier time. All the gravel-flats are on the western side, and that looks like a tolerably steady move from one side to the other. Mr. Smith has included among his evidence historical and documentary matters; I think that he will often find that particular class of evidence not worth much; it may sometimes be very misleading. In the legal

case spoken of, the judge said he would not accept a single map or document as evidence, and I think he saved himself and the jury a great deal of trouble. I hope that Mr. Smith will exercise great judgment as to how he deals with this sort of evidence. He may get in places very good historical and documentary evidence, but you must always be ready to put a query after it. It is to be hoped that this inquiry will be extended lower down the river. It is a big thing, and no doubt Mr. Smith has found it convenient to take a piece first. I believe that there is in this country a great deal to be done in this tracing out of the course of even some of our best-known rivers, such as the Thames, that we may get much information from careful work of the sort Mr. Smith has given us.

Prof. P. F. KENDALL: My interests lie rather in the earlier than in the later phases of the history of the Trent valley, but as a student of the Humber drainage I cannot but be interested in Mr. Smith's paper. The evidence adduced of a general swing to the westward and the explanation offered seemed to be very satisfactory. It was an attempt on the part of the river to shorten a part of its course. Taken with the case of the Lea mentioned by Mr. Whitaker, it pointed to the necessity for caution in accepting the assertion frequently made in geological and geographical text-books that north-and-south-flowing rivers, when uncontrolled, tend to swing to the right under the influence of the Earth's rotation. Here are two rivers, one flowing to the north and the other to the south, swinging to the left in spite of attempts to control their courses. Mr. Smith has shown that there are limits to a river's forbearance, and that when endeavours are made to control its course at one place it promptly reasserts its determination to obey its own natural tendency.

There are one or two points in the early part of Mr. Smith's paper that interested me very much, though I am afraid they do not belong to the main subject-matter of his paper—his allusions to the successive stages of the deepening of the Trent valley, indicated by the terraces, and his suggestion that these changes took place before the close of the Pleistocene period. I am inclined to think, by the evidence afforded by the Trent above Nottingham, that these changes must have taken place in the very early part of the Pleistocene period. The remains in one of these terraces included hippopotamus and rhinoceros. Now, the hippopotamus is a distinctly early element in our Pleistocene fauna, and if I remember rightly, the deposits in which they occur are very little above the Trent level, and I should therefore be inclined to place the high-level deposits at a yet earlier stage. Another point is the Lincoln gap. The level of the rock floor in the Lincoln gap is 23 feet below Ordnance datum. I should like to know how that would be explained by Mr. Smith's study. There is a much larger question that I hoped would have come within the scope of the paper—the strange discrepancy between the very early history of the upper and that of the lower Trent. Streams joining the Trent drainage below the furthest point mentioned by Mr. Smith, flow upon a deeply eroded landscape; a landscape that lies, in one case, 170 feet below Ordnance datum (at Barnby Dun near Doncaster). And that is not an isolated observation. In the upper part of the Trent valley no such deep trough has been discovered, and it is a very difficult problem to decide why there should be this striking discrepancy between this upper and lower course. I would suggest that there has been a warping that has brought up the upper course of the Trent, that has raised it, concurrently with the lowering of the lower course.

Dr. STRAHAN: The remarks made by Mr. Whitaker on the Thames forestall an observation I had in my mind at the time. It is a fact that at Goring a bit of Oxfordshire has, so to speak, travelled over into Berkshire; I know of no historical record of how the river changed its channel, but that it has done so

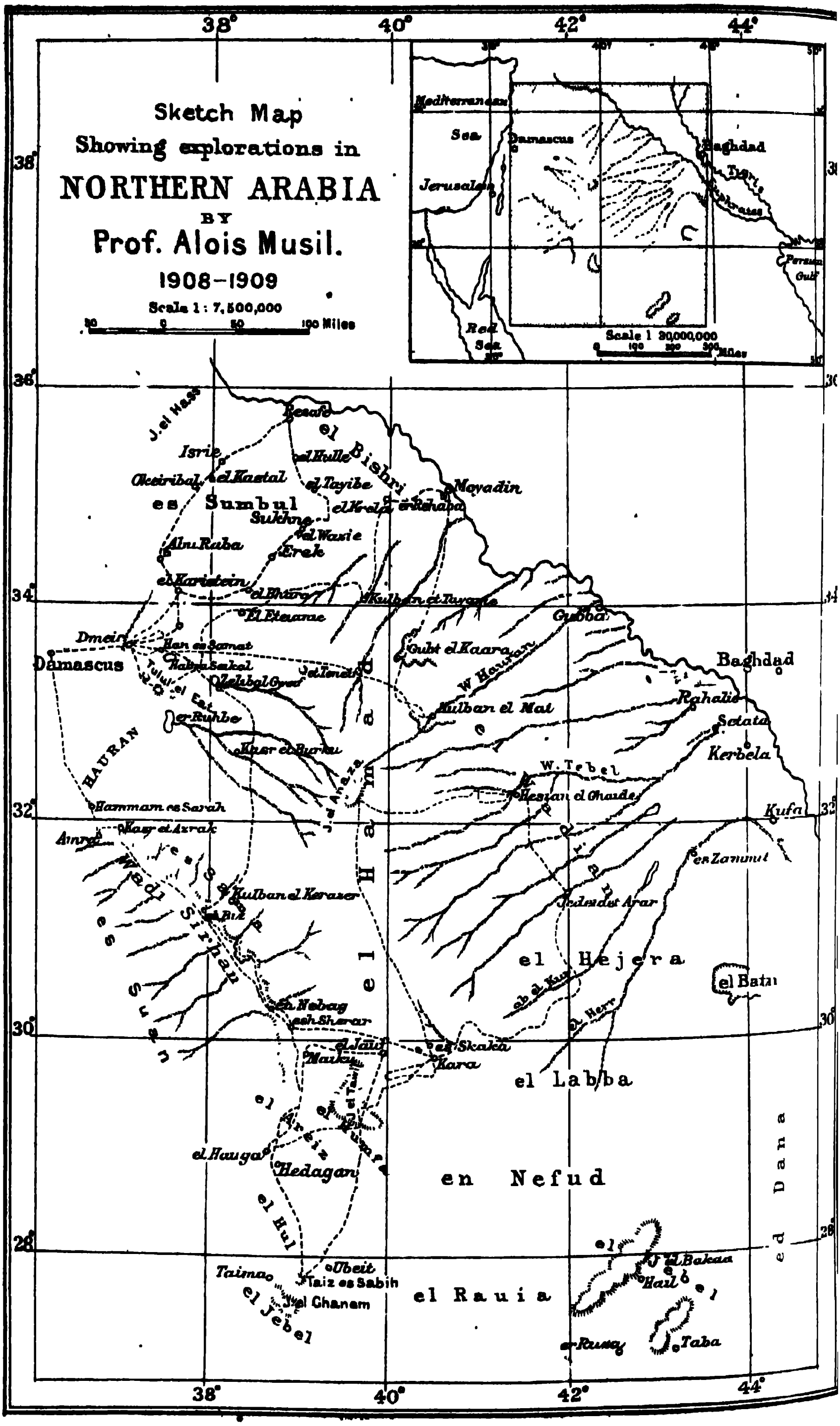
can be seen by comparing the position of the county boundary with that of the present main stream on the 6-inch Ordnance map. Mr. Smith's account of the struggles of the Trent to expand its valley has proved so interesting that I should like to see this line of research followed up in the case of other rivers, and a comparison made between rivers of different character as regards the work they are doing in altering their courses and shaping their valleys.

Mr. B. Smith: With regard to the remarks of Mr. Whitaker about documentary evidence, I know only too well that there is not too much reliance to be placed upon it, and have therefore only dealt in detail with those parts of the valley with which I am well acquainted. In reply to a question by Prof. Kendal as to the depth of the rock floor in the Lincoln gap; I do not think there is any difficulty about it. Although the surface of the latest valley gravels of the Trent is slightly higher than the surface of the present alluvium, their base is considerably below the base of the alluvium. At the very narrow gap near Clifton these latest gravels are below Ordnance datum. The fall from the Spaldford bank to Lincoln is considerable, so that it is not surprising to find the rock floor of the Lincoln gap 23 feet below Ordnance datum. There is no evidence in this area as to the warping of the lower course of the river; the fall in each set of gravels between Newark and Lincoln seems to be much the same throughout. In conclusion, I must thank the members of the department for the very kind way in which they have received this paper.

MUSIL'S EXPLORATIONS IN NORTHERN ARABIA, 1908-9.*

By his last journey—a toilsome and dangerous one—Alois Musil has removed from our maps the blank space which covered the whole large triangle between Arabia Petræa and Syria on the one hand, and Mesopotamia on the other. Leaving Vienna in the beginning of June, 1908, he arrived at Damascus on the 19th. Thence after long negotiations he succeeded in getting into communication with the powerful Sheikh of Northern Arabia, Nuri ebn Shalân. Then with his companion, Sergeant-Major Thomasberger, of the Military Geographical Institute of Vienna, three servants, and nineteen camels, he made his way in the middle of September to the camp of the sheikh, whose travelling companion he then became. Thenceforth he either marched with the sheikh or made lengthy excursions of his own from the camp. First and foremost, he measured out a base to the south-east of Dmeir, some 75 miles east of Damascus. Next, on October 11, he set off with five camels to the steppe regions in the north-east, and, passing hot springs, remains of Roman military stations, and the ruined town of Isrie, arrived at Resafe, 12 miles from the Euphrates. The ruins of churches and palaces in Resafe, with their inscriptions in Greek, Aramaic, and Arabic, proved of high interest for the history of art. This place marked the most northerly point of Musil's journey. Thence directing his course, first to the south-east and then to the south-west, he returned to the same spot by another way on November 2. During three more excursions of a like kind, but more extensive, the explorer made a plane-table survey of the whole region. The last excursion lasted from the end of March to the middle of April, 1909. In the intervals between these expeditions, he undertook shorter survey trips, or, proceeding further with the sheikh's camp, secured ethnographic records. It sometimes happened that, returning from an excursion of his own, he would be a whole week in tracing his way back to the camp.

* Communicated by Dr. Karl Peucker.


Sketch Map
Showing explorations in
NORTHERN ARABIA
BY
Prof. Alois Musil.
1908-1909
Scale 1 : 7,500,000
100 Miles
Mediterranean
Sea
Damascus
Jerusalem
Baghdad
Red
Sea
Persian
Gulf
Scale 1 30,000,000
Resafe
el Bishri
Isrie
el Hulle
Okeiribat
el Kastal
el Tayibe
Mayadin
es Sumbul
Sukhne
Erek
el Karietein
Kulban el Turame
Gubba
Dmeir
Damascus
Gubt el Kaara
W. Hauran
Baghdad
Kulban el Mat
Rahalie
Setata
Kerbela
HAURAN
W. Tebel
Hammam es Sarah
Kusr el Azrak
Amra
Kufa
Wadi Sirhan
Kulban el Kerazer
el Hejera
el Bata
Nebag
esh Sherar
el Jauf
Skaka
Kara
el Labba
el Hauga
Hedagan
en Nefud
ed Dana
el Hul
Taima
Ubeit
Taiz es Sabih
Jel Ghanem
el Jebel
el Rauia
Hail
Taba
38°
40°
42°
44°
36°
34°
32°
30°
28°

These trips, it should be noted, were all carried out under incessant alarm from robber bands or hostile tribes. On his second excursion, which was directed eastwards, Musil was stabbed in the back by a lance and in the breast by a knife, while with his attendants he was stripped of everything down to his shirt. It was only his familiarity with language and manners, and the friendly relations he had established on former journeys, that got him out of this and similar awkward predicaments. He suffered also at the hands of thievish guides, whilst even worse difficulties were caused by the climate and by the badness of the drinking-water, which more than once laid him on a bed of sickness. He passed nights in the open when the temperature varied from 8°·5 to 23° Fahr., and these would be followed by days with an air-temperature of 115° Fahr. Early on December 10, as told by him in a preliminary report to the Vienna Academy of Sciences, he had difficulty in adjusting his headcloth and blanket, so hard were they frozen, while his men hardly dared take hold of the water-bottles for fear of their breaking. After sunrise they warmed them by the fire; for to have kindled a fire earlier might have exposed the party to attack. On the third excursion, which, starting in the south-west part of the region under examination, proceeded southwards, it was with great difficulty that he found a guide. Nobody was willing to accompany him on these "Death paths" which, following on a ride through the desolate black desert of el-Bseita, led into the defiles of the westerly arm of the sandy desert of Nefud. On this excursion Musil pushed as far as the most southerly point of Jebel el Ghanem (27° 50′ N.), where lies the old Nabatæan Necropolis of el-Maiyene. The fourth excursion led him to the eastern and central parts. There, in the hot parched land of el-Hejera, further march was rendered possible only by carrying water in a linen waterproof cover tied to two saddle-bags and carefully guarded by Musil himself. Water-bottles were inadequate to the purpose. Here, in the mountainous land round Jebel Anaza, a peak renowned in fable, they suffered much from cold snowdrifts. On the watershed to the south of Anaza, there is in the Hamad next to no valley-formation, and, throughout an area 220 miles long by 250 miles broad, there was nowhere a single spring nor any standing water.

On April 12 Musil crossed what he describes as the dreadful spurs of the Harra, looking like fortifications and overtopped by extinct craters. May saw him again with the sheikh in the west, engaged mostly in ethnographic labours. In the middle of June he again visited, for the study of its inscriptions, the Khalif's castle of Amra, made known by him on a former journey. On the 19th, with his caravan he bade good-bye to Sheikh Nuri, and by the middle of July the explorer was once more in Vienna. The results of his travels are to be gathered up in the following separate publications, which will contain much matter of geographical interest:—

1. Additions to the map of Arabia Petræa in the north-east and south-east.

2. Map of Northern Arabia, embracing the region from 37° to 44° E. long. and from 36° to 27° N. lat. This will extend to the Euphrates.

3. Topographical report with exact description of the whole area explored, accompanied by many plans, sketches, and photographs.

4. Ethnographical report including an enumeration of all the nomads who have their camping-grounds in Northern Arabia, as well as an ethnographic description of the one remaining representative of the old Arab stock, the tribe of the Rwala.

5–8. Reports on natural history, inscriptions, linguistics, and other subjects.

REVIEWS.

EUROPE.

France.

'Régions et Pays de France,' Joseph Fèvre and Henri Hauser. Paris: Félix Alcan. 1909. 7 *francs*.

The student of French Geography is fortunate in the possession of a series of monographs, by specialists, issued in recent years, on various well-defined areas or districts in France. These studies vary greatly in length and in the importance assigned to different aspects of the subject, though the broad regional treatment is of much the same character throughout. So there is evidently room for a volume like the present, which combines and systematizes the conclusions of the specialists on a definite plan and within reasonable space. The book shows both the advantage and the defects of such a compilation. It is admirable as a guide to the geography of France in general, and is far from being superficial, since the authors had a wealth of material from which to draw. But the application of a uniform system to a great variety of regions does not permit of the due differentiation of the factors in geography which have a greater or less value according to the character of the particular area under discussion. Uniformity is gained only by the sacrifice of due proportion. Moreover, the treatment is necessarily less satisfactory for those districts, notably in the south and part of the centre, where less specialized material is available. None the less, the book is of great value as a guide to recent geographical work in France, and should be particularly useful to the teacher; much specialized work will be needed before England can be treated in the same way and with equal thoroughness. Its value is enhanced by the bibliographies at the end of each section, including references to maps and illustrations as well as texts. In one point the map references are open to criticism. The 1 : 1,000,000 geological map is given as the standard throughout; but it is impossible to verify many of the conclusions in the text from that map. In fact, for some purposes, even the 1 : 500,000 map is insufficient in scale. Illustrations and diagrams are abundant, clear and to the point. A. J. S.

'Erosion of the Coast and its Prevention.' By F. W. S. Stanton. (London: St. Bride's Press. *N.d.* Pp. 68. *Plans.*) A concise hand-book to a subject which has lately attracted more than passing attention through the labours of a Royal Commission. The excellent diagrams have suffered the common fatality of over-reduction.

'Switzerland of the Swiss. By F. Webb. (London: Pitman. 1909. Pp. x., 254. *Illustrations.* 6*s.*) The title is presumably intended to convey that this volume deals, not with the narrow interests of the tourist, but with Switzerland as a State. The people, their industries, art, education, religion, and government are the principal topics of a useful work of reference.

'Wanderings in the Roman Campagna.' By Rodolfo Lanciani. (London: Constable. 1909. Pp. xiii., 378. *Map and Illustrations.* 21*s.*) A delightful volume by an author full of enthusiasm for all the interests of the Campagna, from its antiquities to its biology. But as those who know his work will expect, the antiquarian is his principal interest, and, as a geographical study, the contrast between the Campagna of the Empire and that of to-day is valuable. At the cost of great weight, the volume is beautifully illustrated.

'The Pyrenees.' By H. Belloc. (London: Methuen. 1908. Pp. viii., 340. *Illustrations and Maps.* 7*s.* 6*d. net.*) Mr. Belloc has written an excellent

practical guide for those who wish to climb in the Pyrenees. He has not sought to write an ordinary guide-book, but to set down what cannot be found in such books—the things which he himself only learned slowly during several journeys and after much reading, and which he would like to have been told before he first set out. Apart from detailed descriptions of several districts, the volume contains, among other useful information of a general character, two illuminating introductory chapters on the physical nature and political character of the Pyrenees. The author reveals himself as an artist in a large number of sketches of varying value, while the rough but practical sketch-maps which abound through the book, will be regarded as one of its most useful features by those who venture among the Pyrenees.

ASIA.

Asia Minor.

'The Thousand and One Churches.' By Sir W. M. Ramsay & Miss Gertrude L. Bell. Illustrated with photographs and plans. Pp. xiv.–580. Hodder & Stoughton. 1900. 20*s. net.*

The title of this book, which refers to the ruins of Bir-Bir-Kilisse in ancient Lycaonia—actually the ruins of not more than fifty early churches—does not promise much geographical information; but, nevertheless, Sir William Ramsay's introductory chapter on the site and its surroundings treats of questions of interest to readers of this *Journal*. The chief of these is the hydrography of the Kara Dagh group of mountains. He brings out clearly the contrast between its condition in antiquity when adequate measures were taken for storing water, and its condition now that the old works have been allowed to decay. What he tells about the Kara Dagh and also about the irrigation system of the Konia plain (now in process of restoration) shows that we need not presuppose any serious meteorological change to account for the altered state of this region. It was fertile and well populated in antiquity, simply because extensive and well maintained works of engineering science existed then. Incidentally both Sir W. Ramsay and Miss Bell show further that the uppermost mountain levels, now generally deserted and wild, were once the resort of men even in very remote times, and in some cases were permanently inhabited. In the last chapter Sir William Ramsay discusses once more the problem of ancient topography which centres round the name and coins of Barata. The intermediate chapters are from Miss Bell's pen, and deal with the architectural features of the Bir-Bir-Kilisse churches in particular and of Anatolian and Syrian churches in general, whose construction falls between the fourth and eighth centuries; but the large question, to whose solution they make a notable contribution—the question raised by Strzygowski in his *Orient oder Rom*—is not without geographical bearing, since on its solution depend to some extent our ideas of the character and relations of the near Eastern peoples during a large part of classical antiquity. Was the influence of West or of East most strong in Anatolia in Hellenistic, Roman and Byzantine times? Where were the fountain heads of those influences and by what routes did they pass? All interested in these questions will find this finely illustrated book well worth study.

D. G. H.

Ceylon.

'Ancient Ceylon: an Account of the Aborigines and of Part of the Early Civilisation.' By H. Parker. London: Luzac & Co. 25*s. net.*

This admirable record of much minute research, made by one possessing the special qualifications attached to the position of an engineer officer of the Irrigation

Department, Ceylon, has many merits. It is divided into three main parts: I. The Aborigines; II. Structural Works; III. Arts, Implements, and Games; with a chapter on the Origin and Signification of the Cross and Swastika.

The aborigines, like those of many other countries, were described by the earliest immigrants as Rākshasas (demons), Nāgas (nondescript beings with cobras' heads behind their own), and are probably now represented by the Vaeddas and Wanniyas. The immigrants to Northern Ceylon are naturally to be expected from Southern India, and it is probable they were furnished by the Nāyars or Nairs of Malabar. Though there is no direct proof of such immigration, there is, besides its geographical probability, evidence in the existence among the Kandian Sinhalese of features resembling those of the Indian Nāyars.

The Yakkhas or Vaeddas are mentioned in the early Sinhalese histories, and it is recorded, in the Mahavansa we believe, that Pandukābhaya, the nephew of the king, with their assistance, defeated and killed his uncle and reigned at Anurādhapura, where he established his Vaedda allies on three sides of the city. This happened about 308 B.C., and he reigned to about 275 B.C. His character is that of a wise and impartial ruler, who, besides beautifying his capital, promoted and encouraged irrigation works on a great scale; these mainly took the form of holding up vast volumes of water by means of embankments placed across the lines of drainage. The modern Vaeddas are great hunters; they are subdivided into coast Vaeddas, village Vaeddas, and forest Vaeddas. Their mode of life, their food, weapons, and hunting are all carefully described; the author remarks on their amazing power of passing through thick jungle like shadows so quietly as to be able to approach all animals except the pea-fowl and kill or wound them before they are aware of the presence of the hunter. They have no fear of elephants, bears, buffaloes, or other beast the forest contains, whilst the leopard is said not to attack them.

As may be imagined from the author's professional training, Part II. on Structural Works is of special interest. It deals with an examination of bricks in order by their measurements to fix approximately the dates of the chief buildings, and goes on to describe the buildings and ruins themselves, the lost cities, and the earliest irrigation works. Finally, Part III. treats of inscriptions, coins, weapons, and tools, and games indoor and out.

The chapter on the Cross and Swastika well repays attentive perusal; the development of the latter from the former has led the author to a solution which, whether accepted in its entirety or not, provides at least a possible reason. The decision as to whether it is adequate is left to others.

There are fully 700 pages in the book, and 275 illustrations and plates.

W. Broadfoot.

Northern China.

'The Great Wall of China.' By W. E. Geil. London: Murray, 1909. *Map and Illustrations. Price* 21*s. net.*

In spite of imperfections, this work, as a record of exploration, may fairly claim to be unique. No previous traveller seems to have ever contemplated or attempted to examine this astounding structure from end to end, much less carried such a project into effect. In fact, the task of thoroughly exploring the Great Wall still awaits fulfilment, for its loops, supplementary branches, and older and derelict sections are so numerous that extensive examination would be a far more lengthy and tedious business than the journey recorded in the present work. Dr. Geil is somewhat obscure as to his exact line of route, and his map is most unsatisfying, from a geographical point of view. But the numerous photographs

of the Wall reproduced in the book before us, though reduced in scale and size, are undeniable evidence of the reality of this "cross-country" journey, and of the remarkable eccentricities and varieties of design that in the course of twenty centuries have crept into this wonder of the world. For, be it understood, there is nothing like the uniformity in the alignment of this great rampart that one might infer from Prof. von Mollendorf's rather theoretical brochure on the subject. Having ourselves explored part of the Wall, we can testify that, so far as the easternmost section is concerned, the conformation of the structure varies according to the nature of the ground, and this would appear to be its pervading characteristic throughout, so far as Dr. Geil's photographs enable one to judge. The author landed at Ching-wang-tao, the well-known harbour on the Gulf of Pechili, and thence followed the Wall westward from Shan-hai-kwan, past the Mule horse-pass and the Ming tombs, along the Inner Wall to where it rejoins the northern loop on the borders of Shansi. Thence, proceeding in the main westwards, through the southern Ordos country and Kansu. The chief halting-places were Ning-hsia, Chun-wei, Lanchou-fu, Liang-chou-fu, Kanchou, Suchou, and Kia-yü-kwan, the famous western gate on the verge of the Central Asian desert. A *détour* to Sining enabled the author to bring back some valuable information as to a section of the Wall west of that town and hitherto practically unknown to European writers. Mr. H. F. Ridley, the well-known missionary resident at Sining, has furnished Dr. Geil with a map of this rediscovered wall, and curiously enough it seems to bear out the testimony of the old monk Grueber (see Astley's 'Collection of Voyages'), who makes special mention of "a vast wall" running continuously from Sining to Suchou. The photographs of this part of the journey are particularly attractive, mainly owing to the remote and unfrequented character of Western Kansu, while special interest attaches to the illustrations of Kia-yü-kwan, where the Wall comes to its distant western end. On the whole, we may be permitted to wish that the author had given us rather less Chinese history and legendary lore and rather more geography. He certainly appears to have penetrated through some particularly interesting tracts of North-Western China, but the absence of a methodically written narrative, the mixing up of incidents of travel with the diaries and translations of his followers, and the difficulty of connecting the numerous excellent photographs with the very inadequate sketch-map supplied, all help to detract from the merit of a work which might without much trouble have been made of greater scientific value.

East and Central Sumatra.

'Auf neuen Wegen durch Sumatra. Forschungsreisen in Ost- und Zentral-Sumatra, 1907.' Von Max Moszkowski. Berlin: Dietrich Reimer (Ernst Vohsen). 1909. Pp. 328. *Price, bound*, 14*m*.

The author travelled in the Sultanate of Siak in east Sumatra and in the Rokan States, on the western side of the Sultanate. He paid great attention to the ethnography of the tribes inhabiting these countries—the Tapungs, Akits, and Sakais, and gives numerous drawings of Malay houses, oil- and sugar-presses, baskets, fishing implements, etc., of the natives. Perhaps the most interesting information is that on the Sakais, one of the most primitive races in the world. As far as M. Moszkowski could ascertain, they have no religious ideas of their own, even the superstitions now prevalent among them being borrowed from the Malays, as well as their tools and implements, except the most primitive. In some of their customs they differ from their brethren in the Malay peninsula. M. Moszkowski is a biologist, and he made collections of birds and animals, and also of some botanical

specimens, lists of which are appended. The illustrations are numerous and interesting.

'Travel and Sport in Turkestan.' By Captain J. N. Price Wood. (London Chapman & Hall. 1910 [1909]. 15*s. net.*) A pleasantly written record of travel and shooting. The author started from Kashmir, and was fortunate enough to secure permission to go by the Gilgit road and the Hunza valley, emerging into the Taghdumbash Pamir and Turkestan by the Killik pass. The path which descends from the pass leads into the Karachukur valley, a wedge of Chinese territory driven in between Russia and India, and actually meeting a similar tongue of Afghan territory, which approaches from the west. It is thus a case of where four instead of three states meet. *Ovis poli* was here secured, as well as ibex, wapiti, bear, and other big game in the Tian-shan valleys, which were the author's main objective. It is interesting to read that the telegraph is making progress in Turkestan, and that Kashgar is now actually in direct connection with Peking. Captain Price Wood's return home lay through Russian territory.

'L'Empire Japonais.' By J. Dautremer. (Paris: Guilmoto. 1910. Pp. 308. *Map and Illustrations.* 6 *frs.*) A close study of the economic and administrative conditions of Japan. The geographical introduction is somewhat perfunctory and the usual absence of an index goes far to destroy the value of the book as a work of reference.

'L'Ile de Java sous la domination française.' By O. J. A. Collet. (Brussels Falk. 1910. Pp. xiii., 558. *Plans and Illustrations.* 10 *frs.*) This book deals with a subject on which works of easy reference are rare—the history of the Malay Archipelago at the time when French interests were prominent there, and came into conflict with those of Holland and England. Military operations are dealt with at length, and illustrated with plans. The book is simply written and replete with detail, and, being well indexed and provided with a full analysis, is easy to consult.

'Dans les Marches Tibétaines.' By Jacques Bacot. (Paris Plon. 1909. Pp. iii., 216. *Map and Illustrations.* 3 *fr.* 50.) M. Bacot travelled in 1907 in the parts of Tibet which lie to the north-west of Yunnan, about the lower part of the Mekong headwaters. He adds to our knowledge of this territory a number of vivid impressions of the land and of the people, with many of whom he established the most friendly relations. The French language always seems to enhance the pleasure of reading a book of this sort.

'Through the Malay Archipelago.' By Emily Richings. (London: Henry J. Drane. 1909. Pp. 251. 6*s.*) This "slight volume" has been "written as a *compagnon de voyage* to the wanderer who adds a cruise in the Archipelago to his Eastern itinerary." It contains a description by a lady traveller of a tour through the Dutch East Indies, and embodies a good deal of information of a tourist character about a part of the world which has not figured to any great extent in English travel literature. It is, however, an irritating volume, spoiled by excessive word-painting, and supplied with neither illustrations nor maps.

AFRICA.

Exploration and Sport in Eastern Equatorial Africa.

'In Afrikas Wildkammern als Forscher und Jager.' Von Dr. A. Berger. Berlin. Paul Parey. 1910.

Dr. Berger, accompanied by Captains J. Roth and Kurt von Donner, has almost out-Schillingsed Schillings (who, by the by, seems to have settled down into the placid position of a professor, and who contributes a preface to the work under review) in his splendid photographs of wild life in the most wonderful part of

Eastern Equatorial Africa." Whether it be landscapes, wild beasts, or wild peoples, his pictures attain, perhaps, the highest rank in any as yet produced. His motto has been, he tells us, "Truth in word and picture." The photographs possess the rare distinction of being completely untouched, and there is not too much about them of the flashlight and the clever trick—those cords, traps, tents, and camera disguises which occasionally obtrude themselves into the modern surprise picture of beast or bird.

The three travellers, whose experiences are recorded in a text which is as interesting as its photographs, entered British East Africa by the Mombasa-Uganda railway, and travelled thence and by caravan to the Guaso Nyiro, Lake Baringo, North Elgon, the Ripon falls of the Nile, Kampala and Entebbe, Lake Albert, the Mountain Nile, Gondokoro and Egypt. They also made an excursion in the direction of Mount Kenya. Although a great many acknowledgments of indebtedness for kindness, etc., appear in the preface, these are all directed to Germans in Germany and London, and nothing is said about the British officials who seem to have been both kind and helpful to this expedition.

But, judging from some of the photographs and statements, these German gentlemen seem to have been unacquainted with the English language, or, at any rate, unable to interpret and apply the published Game Regulations and the notifications about Game Reserves. Or, it may be, that, as occasionally happens, they were accorded special privileges. At any rate, though the fast disappearing white-mantled Colobus monkeys are supposed to be very strictly protected, there is a photograph on p. 244 of a great heap of slain "Colobus Affen," and that, too, in what I believe is still a Game Reserve. But, after all, as the British themselves honour these laws more in the breach than by observance, there is no need to grudge a similar laxity of control to German travellers who make such splendid use of their opportunities as is the case with the writer of this book and his friends (some of whom, though not actually his companions on this particular journey, have lent him further photographs).

This book will be a feast of delight to all who are interested in the fauna and peoples of Africa. It should certainly be translated into English, because it is valuable for its text as well as its illustrations, illustrations of a fauna which is disappearing so rapidly under the raids of "sportsmen" that its more interesting features will probably have ceased to exist in another twenty years.

When the present writer in his work on Uganda ventured to make some remarks from personal observation of the difficulty of descrying giraffes amongst the acacia trees, and still more amid those vestiges of burnt forests which were the result of bush fires, his statements as to this mimicry were somewhat disputed by Mr. Selous. But it is clear there is this resemblance between gaunt tree trunks and immobile giraffes: witness the illustrations opposite pp. 142 and 144. For sheer beauty, attention might be drawn to the photographs (opposite pp. 214 and 120) of flamingoes on Lake Hannington. The travellers killed several white rhinoceroses in the Lado enclave, and of these magnificent photographs are given. They believe themselves to have discovered a new species of hyena in the Elgeyo Gorge, but it is doubtful whether this is more than a mere variation of the *Crocuta* type.

H. H. Johnston.

'The Land of the Golden Trade.' By John Lang. (London: Jack. 1910. Pp. ix., 315. *Maps and Illustrations.* 6s.) This volume, in the now well-known 'Romance of Empire' series, may be rather florid in style for the taste of some readers, as regards both the writing and the coloured illustrations. But it shows a proper appreciation not only of romance but of perspective in the chequered

history of the white man in connection with the west coast of tropical Africa from the earliest times. This book will maintain the reputation of the series as giving really good value at its price, and filling the purpose it claims to fill.

'Guide to Egypt and the Sûdân.' (Sixth Edition. London: Macmillan. 1909. Pp. xvii., 177. *Maps and Plans.* 5*s.*) Revision in every necessary direction has been applied to the new edition of this favourite guide, which is well printed and conveniently small, while the maps are very fair.

'Labour in Portuguese West Africa.' By W. A. Cadbury. (London: Routledge. 1910. Pp. xii., 187. *Map.* 2*s.* 6*d.*) The interest of the author in the subject with which this book deals has been recently brought before the public, which should therefore welcome his views. We learn that the book has been translated and will be widely distributed in Portugal. A complete survey of the conditions of native labour in Angola and the Portuguese islands is given.

'Journal of our Mission to Fez.' By the Military Attaché (Colonel Count Gleichen). (London: Harrison. 1909. Pp. 108. *Illustrations.* 2*s.* 6*d. net.*) This is a delightful unofficial narrative of the journey of the British Mission to Fez last year; humorous, entertaining, and instructive as well, for the writer spent much time on a survey of Fez. He therefore came to know it well; he also carefully describes the country passed through *en route*, and provides good photographs. The narrative also presents intimate sidelights on current events in, and the condition of Morocco.

AMERICA.

The Chile-Argentine Frontier.

'La Frontéra Argentino-Chilena. Demarcación General 1894–1906.' Buenos Aires: Talleres Gráficos de la Penitenciaria Nacional. 1908. 2 vols. Pp. 497 + 519.

The dispute as to the boundary, which lasted sixty years, was at last brought to an end in 1903, the frontier where the commissioners of the two countries had failed to come to an agreement being defined by King Edward after investigations by a British Commission under the late Colonel Sir T. Holdich. The regions where the frontier question was submitted to arbitration were the Puna de Atacama in the north, lying between the Cordillera de los Andes and the Cordillera Real de Bolivia, and in Magallanes, where the Cordillera de los Andes is broken through by rivers flowing from a watershed to the east. The new frontier was described at the time in the *Geographical Journal*, and illustrated by a map, the line of frontier awarded by arbitration being of the nature of a compromise. As a result of this arbitration and previous concessions, Chile gained, according to the figures given in this volume, 53,213 square miles of territory. In this publication the history of the dispute is sketched, and all the treaties and acts concerning it are reproduced, and geographical co-ordinates are given of the landmarks set up on the frontier, with their altitudes, and also of other points determined by calculation during the course of the work, together with maps, diagrams of triangulation, etc. The volumes also contain some general descriptions of the country through which the frontier runs, in four chapters, the first dealing with the Puna de Atacama, of which 3900 square miles belongs to Chile, and where the northern extremity of the frontier is situated at the Cerro Zapaleri, in 22° 48′ 53″ N. lat. and 67° 11′ 18″ W. long. In the second section, from lat. 27° 46′ to Monte Tronador in lat. 41° 10′, the Andes form a continuous chain, with only one break occupied by the Lago Pirehueico. The basin of the Lago Lacar, lying to the east, was assigned by arbitration to Argentina. In the south, Patagonia and the inlet of Ultima Esperanza, the work of the commission under Colonel Holdich was particularly heavy, and the whole country was investigated. Lastly, a short sketch is given

of Tierra del Fuego, of which 12,300 square miles were secured to Chile by the treaty of 1881.

Botanical specimens were collected by some of the Argentine officials accompanying Colonel Holdich, and are catalogued here.

Southern Chile.

'Censo Jeneral de Poblacion i Edificacion, Industria, Ganaderia i Mineria del Territorio de Magallanes, República de Chile.' Por Lautaro Navarro Avaria, Médico de Ciudad, Director de la Oficina del Censo. Punta Arenas, 1908. Vol. 1, pp. 382; Vol. 2, pp. 563. *Price* $24.

The population to which this elaborate and carefully compiled census refers is only 13,309, spread over an area about one-fifth larger than England, the density being less than 0·2 per square mile. During the eleven years since the last census of the Republic in 1895 the population has increased 157·42 per cent. It seems at first singular that in such a new country the urban population in Punta Arenas, the great commercial centre, and the insignificant Porvenir in Tierra del Fuego, should form 79·81 per cent. of the total. This is due to the fact that cattle and sheep grazing, for which comparatively few men are required, is almost the only rural industry. The proportion of foreigners is large, namely 35·93 per cent., Austro-Hungarians being the most numerous with 30·71 of the foreign population, and British subjects coming second with 15·22 per cent. The tables of demography and nosology are for some reason relegated to the end of the second volume. It appears that the birth-rate is exceptionally high, 40·21 per thousand, while the mortality, though lower than in the Republic as a whole, is still 23·29, still-born infants included. It should be stated that the nomad Indians, not very numerous, are not included in the census, but only the few Indians collected at the mission stations in Tierra del Fuego.

Though grazing is the chief occupation in Magallanes, the number of domestic animals is only slightly in excess of the average for the Republic, namely 23·41 per cent. Of sheep alone the percentage is, however, 43·78. In the census year, 1906, there were in the territory 1,873,709 sheep, 37,804 cattle, and 24,010 horses, besides a few pigs and goats. The quantity of wool exported was about 147,300 cwts., valued at about £480,900, three-quarters being shipped to Great Britain. The price of the better qualities had risen to $9\frac{1}{16}d.$ per lb. in 1906. Mining is still in its infancy. In 1907 concessions were granted for 287,614 acres, mostly for auriferous sands, the other minerals being copper and coal. The foreign exports of the port of Punta Arenas in 1906 valued £639,400, and the imports £600,600. More than 32 per cent. of the imports, in value, come from Great Britain, which takes 76 per cent. of the exports.

Landed property, industries, financial undertakings, education, the press, and many other subjects are dealt with in these volumes, which are provided with diagrams, illustrations, and maps.

'The Yukon Territory.' (Ottawa: Government Printing Bureau. 1909. Pp. 140. *Map and Illustrations.*) This is a publication of the Ministry of the Interior of the Dominion Government. Within its small compass it is thorough, deals with the history of the territory, and the resources (mining, game, etc.), of the various districts in detail, and quotes a number of authorities. There is little of the dryness of the official publication here; the narrative and description are even fascinating, but full information is also given as to administrative arrangements and economic conditions.

'British Columbia Coast Names.' By Captain J. T. Walbran. (Ottawa: Government Printing Bureau. 1909. Pp. 546. *Map and Illustrations.*) This remarkable work is arranged in gazetteer form. It covers all names given from 1592 till 1906, and seeing that the derivation of the names on this sea-board have to be sought in sources so widely different as English, Spanish, and various native Indian speeches, the erudition necessary to its compilation is obvious. The book ought to set an example. It was only at the British Association Meeting at Winnipeg last year that the urgency of ethnographical investigation in its widest sense (which would embrace such research as this work contains) was insisted upon, before the data should become overlaid in the course of the development of the country.

'Canada: the Empire of the North.' By Agnes Laut. (Boston: Ginn. 1909. Pp. xxvi., 446. *Maps and Illustrations.* 7*s.* 6*d.*) A straightforward story of the Dominion, written with a full appreciation of the romance and excitement characteristic of its history. The authoress has made full use of her knowledge of the country.

'Mexico: the Wonderland of the South.' By W. E. Carson. (New York: Macmillan. 1909. Pp. xi., 439. *Map and Illustrations.* 10*s. net.*) Mexico not unnaturally attracts writers of this type of work, the catalogue of which must be long by this time. The present author, however, would seem to have studied the Mexican, his social conditions and system of government and administration more deeply than most.

GENERAL.

A Bibliography of Ptolemy's Geography.

'Ptolemy's Geography: A brief Account of all the Printed Editions down to 1730.' By Henry N. Stevens. Second Edition. London: Henry Stevens, Son & Styles, 1908.

The many editions of Ptolemy's 'Geography,' brought out at close intervals for a number of years, from 1475 onwards, possess an importance beyond that which appeals to the book collector, by reason of the constant addition of modern material at the hands of successive editors and map-makers; so that a complete collection of the various editions presents a striking view of the development of modern geographical conceptions, on the academic side, during the century or more following the discovery of America. Probably the nearest approach to a complete collection is that begun by the late Mr. Henry Stevens of Vermont, and continued by his son (the author of the present booklet), which is now in the possession of Mr. E. E. Ayer of Chicago. Excluding a limited number of early works illustrative of, or supplementary to, the 'Geography,' it embraces over forty separate editions, only one or two of any importance being wanting.* On a series of book-plates, specially designed for the collection, brief statements of the main points in regard to each edition were inserted in the respective volumes, and these statements are reprinted in the book now before us. Mr. Stevens, whose knowledge of the bibliographical history of the 'Geography' is not easily to be matched, gives also a useful outline of the main facts connected therewith, and enters into somewhat fuller detail regarding some special points which have lately come to his personal knowledge. They relate to some striking variations in the famous Ulm edition of 1482, the two issues of which are so curiously mixed up in existing copies, that out of twelve of these examined by Mr. Stevens no two have been

* Of these the Society possesses about twenty, including one specimen at least of almost every important type except that of Bologna, 1482 (?).

found exactly alike. This is of interest mainly to bibliographers, but a variation of more importance geographically is the existence, in a copy purchased in 1901 for the John Carter Brown Library, of a map of the world differing from that found in all other known copies, and, in Mr. Stevens' opinion, representing the earliest attempt, in a printed map of the world, to depart from ancient traditions. It is to be hoped that Mr. Stevens may continue his studies in this direction and eventually publish the results.

THE MONTHLY RECORD.

THE SOCIETY.

The Society's Awards for 1910.—With the approval of His Majesty the King, as Patron of the Society, the Council has awarded the royal medals for 1910 to Lieut.-Colonel H. H. Godwin-Austen, F.R.S., and Dr. W. S. Bruce. Colonel Godwin-Austen receives the Founder's Medal for his geographical discoveries and surveys along the north-eastern frontier of India. He was the pioneer explorer of the Karakoram and Kashmir borderland, and his name will always be associated with the first acquisition of accurate knowledge respecting Mount Godwin-Austen, or K_2. With his surveys he combined geological researches, and in both respects his work was of the highest order. He was the first to open up the palæontological records of the Siwaliks, and, as a member of the Eden Mission, the first to reduce to order the topography of Western Bhutan. The Patron's Medal is bestowed on Dr. Bruce for his explorations in the Arctic and Antarctic regions. In the Antarctic regions he served as naturalist on board the *Balæna* in the region south of Cape Horn in 1892–3, and in 1902–4 commanded the Scottish expedition on board the *Scotia*, which carried out important scientific researches in the Weddell sea, and traced for a distance of 150 miles the previously unknown coast which figures on the maps as Coats Land. In the Arctic regions he acted as zoologist to the Jackson-Harmsworth expedition to Franz Josef Land, as well as to Major Andrew Coats's expedition to Novaya Zemlya and the Barents sea. He has been on several expeditions to Spitsbergen, and among other explorations in the archipelago has carried out a detailed survey of Prince Charles Foreland, the results of which are nearly ready for publication. Among the other awards for 1910, the Murchison Grant falls to Dr. Carl Skottsberg for his work as leader of the Swedish expedition which, in 1907–9, conducted extensive explorations and scientific researches in the Falkland islands, Magellan straits, Tierra del Fuego, Patagonia, the Chilean Andes, and Easter island. Dr. Skottsberg has contributed a series of valuable papers to the *Journal* of the Society, embodying the chief results of this expedition. He previously served as botanist to the Swedish Antarctic expedition under Dr. Otto Nordenskiöld. The Gill Memorial is awarded to Mr. Douglas Carruthers

for his journey in North-Central Arabia, a paper on which he recen read before the Society. Before his visit to Arabia he spent a considera time in the mountains of Turkestan, where he did important scient work, the results of which he has communicated for publication in *Journal*. He was also one of the naturalists engaged in the Bri Museum expedition to Ruwenzori. The Cuthbert Peak Grant awarded to Lieut. C. E. Fishbourne, R.E., who, as a member of Uganda railway extension survey party completely triangulated surveyed an area of 3500 square miles in the Lake Kioga region. T work, which was of a high order of accuracy, he has described in *Journal*. The recipient of the Back Bequest is Mr. Hanns Visc who, in 1906, journeyed from Tripoli to Nigeria, across the East Sahara, and afterwards read a paper before the Society on the result

EUROPE.

Sheep and their Products in France.—An interesting article on this sul by L. Perruchot, illustrated by a distribution map, has lately appeared in th *Géographie*, and has been also issued as a reprint. Sheep reach a total of over to the square mile in the districts of Beauce and Brie, and over 130 in Soisso Vexin, and Picardy. The above group of regions is sharply limited on the but eastwards borders on a zone with 80 to 100 sheep per square mile, endin thinly populated Lorraine. Outside the basin of Paris, Limousin and Marche, Champagne-in-Berry and Boischaut, have an ovine population, centring in plateau of Milleraches, of 176 to 210 per square mile. South of the central m the ovine population is centred in the Garigues and the Causses. In Prov and the Dauphiné Alps, sheep abound most in the plain of Crau, and next to Camarque, the plain of Vaucluse, and the valley of Barcelonnette. In the Pyre regions, the plain of Roussillon and the eastern valleys are the most populous. two regions with least density lie, one to the west, comprising all the lands o Armorican massif and Poitou, the other to the east, comprising the eastern p the central massif, the Saône plain, the Savoy Alps, Jura, and Lorraine. Ot the basin of Paris, in which sheep are artificially fed in stall on trefoil, luc etc., the ovine distribution above indicated represents the differences of the diff parts of France in respect to their suitability as habitats for sheep. Differen climate, relief, and soil have differentiated the sheep into the sheep of the of the south, of the plain, of the mountain, of calcareous, and of non-calca soil. Again, the sheep may be divided into the two great classes of indigenou imported. The former comprise the sheep of the Pyrenees, of the Central Pl of the basin of the Loire; the latter, the "merino" in the south and the En in the north. Sheep have decreased from 32,151,430 in 1840 to 17,461,397 in The wool produced in 1907 amounted to 43,000 tons.

Mountain and Valley Winds on Lake Garda.—Some interesting in gations have lately been made with a view to ascertaining the causes of c strong daily oscillations of level on Lake Garda. It was, of course, evident these were connected with the daily change between mountain and valley win nothing was known respecting the joint action of the forces bringing them either in this precise locality or generally. Dr. Albert Defant, assistant Central Institute for Meteorology and Geodynamics in Vienna, has, after inve tions of the problem, arrived at the following principal results. From the w

The Guanches of Tenerife, The Holy Image of Our Lady of Candelaria.

With the Spanish Conquest and Settlement. By the Friar Alonso de Espinosa, of the Order of Preachers. 1594. Translated and Edited, with Notes and an Introduction, by Sir Clements Markham, K.C.B. With a Bibliography of the Canary Islands, A.D. 1341–1907, chronologically arranged, with the British Museum press-marks, and an alphabetical list of authors, editors, and titles. 2 Maps, by Sir Clements Markham, and 4 Illustrations. Index. pp. xxvi. 221.

History of the Incas.

By Pedro Sarmiento de Gamboa. 1572. From the MS. sent to King Philip II. of Spain, and now in the Göttingen University Library. And The Execution of the Inca Tupac Amaru. 1571. By Captain Baltasar de Ocampo. Translated and Edited, with Notes and an Introduction, by Sir Clements Markham, K.C.B. With a Bibliography of Peru, A.D. 1526 to 1907, chronologically arranged, and an alphabetical list of authors, editors, and titles. 2 Maps, by Graham Mackay, R.G.S., and 10 Illustrations. Index. pp. xxii. 395.

——— Supplement. A Narrative of the Vice-Regal Embassy to Vilcabamba, 1571, and of the Execution of the Inca Tupac Amaru, Dec. 1571. By Friar Gabriel de Oviedo, of Cuzco, 1573. Translated by Sir Clements Markham, K.C.B. Index. pp. 397–412.

Conquest of New Spain.

The True History of the Conquest of New Spain. By Bernal Díaz del Castillo, one of its Conquerors. From the only exact copy made of the Original Manuscript. Edited and published in Mexico by Genaro García, 1904. Translated into English, with Introduction and Notes, by Alfred Percival Maudslay, M.A., Hon. Professor of Archæology, National Museum, Mexico. Vol. I. (Ch. i lxxxi). With a Portrait of Cortés, a Bibliography of Mexico, and an alphabetical list of authors, subjects, and titles. 2 Maps and 7 Illustrations. Index.

Vol. II. just issued.

The Annual Subscription—entitling the member to the year's publications—is One Guinea.

Gentlemen desiring to be enrolled as members, or to receive a copy of the prospectus, should send their names to the Hon. Secretary, J. A. J. de Villiers, British Museum, W.C. Applications for back volumes should be addressed to the Society's Agent, Mr. Quaritch, 11, Grafton Street, New Bond Street, London, W.

HAKLUYT SOCIETY.

LATEST PUBLICATIONS.

The Voyages of Pedro Fernandez de Quiros, 1595 to 1606.

Translated and Edited by Sir CLEMENTS MARKHAM, K.C.B. With a Note on the Cartography of the Southern Continent, and a Bibliography, by BASIL H. SOULSBY, F.S.A. 2 vols. 3 Maps. Bibliography. Index.

John Jourdain's Journal of a Voyage to the East Indies, 1608–1617.

(Sloane MS. 858, British Museum.) Edited by WILLIAM FOSTER, B.A., of the India Office. pp. lxxxii. 394. With Appendices, A—F, and a Bibliography, by BASIL H. SOULSBY, F.S.A. 4 Maps. Index.

The Travels of Peter Mundy in Europe and Asia, 1608–1667.

(Bodleian Library, Rawl. MSS. A. 315.) Vol. I. Travels in Europe, 1608–1628. Edited by Lieut.-Colonel Sir RICHARD CARNAC TEMPLE, Bart., C.I.E. 3 Maps and 3 Illustrations. With a Bibliography, alphabetically arranged. Index. pp. lxiii. 284.

East and West Indian Mirror.

By JORIS VAN SPEILBERGEN. An Account of his Voyage Round the World in the years 1614 to 1617, including the Australian Navigations of JACOB LE MAIRE. Translated from the Dutch edition, "Oost ende West-Indische Spiegel," etc., *Leyden*, 1619, with Notes and an Introduction, by JOHN A. J. DE VILLIERS, of the British Museum. With a Bibliography and Index by BASIL H. SOULSBY, F.S.A. 26 Illustrations and Maps. Index. pp. lxi. 272.

A New Account of East India and Persia.

In eight Letters, being Nine Years' Travels, begun 1672, and finished 1681. By JOHN FRYER, M.D., Cantabrig., and Fellow of the Royal Society. Edited, with Notes and an Introduction, by WILLIAM CROOKE, B.A., Bengal Civil Service (retired), Editor of "Hobson Jobson," etc. Vol. I.

J. Hann it is known that the phenomena of mountain and valley winds depends on the formation of barometric gradients, *i.e.* neighbouring contrasts of barometric pressure. The next problem was to determine them numerically. The steepest gradient operating from the mountains towards the plain of the Po, and so producing the mountain wind of the morning hours, averages 0·85 mm. The gradient operating towards the Alps and producing the afternoon valley wind amounts to 1 mm. The facts inferred from the course of the gradients agreed perfectly with the records of the automatic limnograph at Riva. An essential factor in the operations of the gradients was thus shown to be the descent down the mountain slope of the mass of air that had been warmed over the floor of the valley and so borne upwards. In opposition to the customary diagram illustrative of mountain and valley winds, it must accordingly be emphasized that in the case of the production of the barometric contrast between mountain valley and open lowland, the determining factor is not so much the gradient operating in the longitudinal direction of the valley, but rather the gradient formed in a sense perpendicular to the direction of the valley.

ASIA.

French Exploration in Cambodia and Annam.—M. Henri Maitre, who in 1906–7 and in 1908 mapped the Darlac plateau in the southern interior of French Indo-China, writes that during the past year he has been engaged in an official mission for the exploration and survey of a practically unknown region in the extreme east of Cambodia, to the west and south-west of the field of his former explorations. He has coupled up his new surveys with those of his former expeditions, and has traversed in several directions a considerable extent of little-known country on the borders of Cambodia, Annam, and Cochin China. Geographically, the principal result of his journeys has been the exploration of a plateau region rising from 800 to 1000 metres above sea-level. It is a softly undulating country, covered with low grass, and rivers flow from it to the north to join the middle Srepok (a tributary of the Sekong, which in turn flows into the Mekong), to the east to join the upper Srepok, to the south to join the Donnai, and to the west to join the Mekong direct. These streams descend from the plateau in magnificent falls varying in height from 20 to 50 metres. To the east the plateau rises into a mountain range with peaks about 1500 metres high. The country is inhabited by savage tribes known by the general name of Moï, an Annamese word meaning "barbarians" or "savages," corresponding to the Laotian word "Kha." These tribes are of Malayo-Polynesian origin, and speak a number of languages, all quite different from one another. Some of the tribes are of a warlike disposition, and received M. Maitre in a far from friendly manner. They go almost naked, wearing only a narrow and dirty cloth round the loins, though they are fond of decorating themselves with glass beads, copper wire, and other ornaments. For weapons they use spears, arrows, and cross-bows, as well as swords and knives. Most of them possess tame elephants, which they capture in wild and uninhabited parts of the country traversed by the tributaries of the Srepok river. At the time of writing, in January last, M. Maitre was engaged in exploring the mountainous country through which flows the upper Donnai river. After surveying the middle course of this stream, which was still unmapped, he proposed to go northwards again to examine the basin of the middle Srepok.

Geological Research in Baluchistan.—Mr. E. W. Vredenburg, assistant superintendent of the Geological Survey of India, has just published two papers in the 'Records' of the survey which throw much light on the economic possibilities of Baluchistan. He and Mr. Tipper, during the winter of 1905–06, traversed a vast area of country in Sarawan, Jhalawan, Mekran, Las Bela, and Seistan, of

which very little had been previously known. Anything like detailed prospecting was impossible, owing to the limited time at their disposal: all that could be done was to indicate in what particular regions prospecting operations might be usefully carried on. In the case of coal, the only trace of it occurs in a comparatively restricted area of the Sarawan district. As regards petroleum, there are two localities where the prospect seems somewhat favourable, viz. Las Bela and southern Mekran, where the rocks belong to the Kojak, or Mekran system, and Kachhi, where they belong to the Siwaliks. The exact localities where the best chances of success are to be found are pointed out by Mr. Vredenburg, who also comments on the sulphur, salt, alumite, and gypsum occurring in the same region. In the course of the tour Mr. Vredenburg was strongly convinced of the desirability of making some provision to save the enormous amount of water that yearly runs to waste in these parts. In the western region more particularly the courses of the Hingol, the Mashkal, the Dasht, and some of their tributaries could be turned to far better account for irrigation by constructing dams at suitable places. The Dasht, especially, traverses large alluvial plains of excellent soil, while, speaking generally, Mr. Vredenburg remarks, "The potentiality of the Mekran seems to me so incomparably superior to that of any other part of Baluchistan, that the matter (the construction of dams and irrigation works) deserves careful consideration. The climate is suited to all kinds of crops: wheat, cotton, indigo, sugar-cane, rice, etc. The population appears intelligent and industrious. If the natural water-supply of the region could be made available to the fullest efficiency, the province could support three or four times its present population, and would become a prosperous annexe of the fertile portions of Sind."

The Pelliot Expedition in Central Asia.—Since the return of M. Pelliot from Central Asia, several articles on his travels and researches have appeared. M. Pelliot and his colleagues, Dr. Vaillant and M. Nouette, were received by the Société de Géographie on December 10, and the account of the proceedings will be found in *La Géographie* for January. It is there recalled that, after spending a twelvemonth at home in making preparations, the expedition left Paris on June 15, 1906, and arrived at Kashgar in August, their chief object being to conduct researches into the traces and remains of pre-Mohammedan Buddhism in Kashgaria. The route, as traced on the sketch-map, lay through Maralbashi, Aksu, Bai, the Tekes valley, Kuchar, Kurla, Karashahr, and, after a somewhat devious excursion to Urumchi and Turfan, Hami, Sha-chow (Tun-Kwang), An-su, Su-chou, Kan-chow, Lian-chow, Lan-chow, Si-ngan-fu, Chen-Chow, and by rail to Pekin. The fruit of the expedition includes several thousand rubbings of inscriptions taken by M. Nouette, which are pronounced to be of great importance. Dr. Vaillant brought back a route-survey covering more than 2000 kilometres, checked by twenty-five astronomical points. The natural history collections consist of eight hundred plants, two hundred birds, numerous mammalia and insects, as well as anthropological measurements. Paintings, carved wooden antiquities, bronzes, and earthenware objects have been also brought back, all of which it is proposed to exhibit in a special gallery of the Louvre. The *Annales de la Société de Géographie Commerciale* (Section Indo-Chinoise), fasc. 4, is devoted to the same expedition, and contains three papers by M. Pelliot, viz. a narrative of the expedition; a short treatise on the nationalities, peoples, and tribes of Chinese Turkistan; and a more elaborate description of what he calls the "mediæval library of Kansu," this being the extraordinary collection of manuscripts at Tun-Kwang, which Dr. Stein had visited only a short time before, and of which he gave such a graphic account in the *Journal* for September last. M. Pelliot appears to have devoted three weeks towards examining a good proportion of this store of thousands upon thousands of manuscripts piled up in the thousand

grottos or halls of Buddha. M. Pelliot is of opinion that the cell was walled up in the first half of the eleventh century, say in 1035. His learned comments on the manuscripts themselves and the languages in which they are written are unsuitable for record here, but it may be mentioned that the manuscripts he has brought home are written in Chinese, Mongol, Tibetan, Uigur, and Brahmi.

Nain Singh's Work in Tibet.—Referring to Dr. Sven Hedin's criticism of the Pundit Nain Singh, and especially of the vagueness of his information respecting the Lake Tashi-bup-tso (*Journal*, vol. **33**, p. 431), the well-known native explorer A-K (Nain Singh's cousin) has written to the *Pioneer* of Allahabad (February 26, 1910), pointing out that an estimate both of the length and breadth of the lake was made by the pundit. In Sir Henry Trotter's account of the Pundit's journey, published in the *Journal R.G.S.*, vol. **47**, 1877, it is stated that "the lake is about 13 miles in length by 8 miles in breadth." The Pundit's itinerary had previously been printed by Sir H. Trotter in his 'Report on the Trans-Himalayan Explorations. . . . during 1873–74–75,' at p. 77 of which the same statement occurs.

American Expedition in North-West China.—The March number of *La Géographie* gives particulars of the explorations of Captain Robert Clark, an American officer and member of the Paris Geographical Society, in Shan-si, Shen-si, and Kan-su, his work having been unfortunately brought to an abrupt close by the assassination of one of his companions. After having measured a base, fixed by telegraphic determination the longitude of Tai-yan-fu in Shan-si, and calculated the height of the curves along the alignment of the railway, the expedition left that city on September 27, 1908, and returned thither about twelve months later. Their route lay through Lin-hsian (Shan-si), Yulun, Sin-te-chou, Yen-nyan-fu, Fu-chou (Shen-si), King-yang-fu, Ku-yuan-chou, King-ning-chou, and Lan-chou (Kansu). Captain Clark's intention had been to travel southwards from thence into Se-chuan, but the murder of his topographer necessitated the abandonment of this project. The results consisted of the determination of eight towns by chronometrical aid, by occultation of the stars, and 24,000 square miles of plane-tabling survey, carried out by Captain Clark with the aid of an Indian surveyor, Hazarat Ali. The zoological and meteorological data were obtained by Mr. Sowerby and Captain Douglas respectively, and the photographs by Mr. Grant.

M. Bacot on the China-Tibetan Frontier.—M. Joseph Bacot, whose travels on the confines of Tibet and Western China were noticed in the *Journal* for August, 1908 (pp. 181–183), has written to Mr. Henri Cordier from Tseku, under date December 9 last, stating that he had just returned from an exploring trip in the direction of Poyul and Nepemaken, in the course of which, however, he had seen neither "the promised land of Tibet nor the Minotaur (Dalai Lama) inhabiting it." The Tibetans had stopped M. Bacot five days after crossing the Salwen, on the road to Sanga-kiu-jong, which is also the high-road to Lhasa. They were, however, accommodating, and offered M. Bacot a horse, with which he might have proceeded further for one or two days to Sanga-kiu-jong itself; but he adds that the local authorities there would certainly have arrested him without much formality. Had times been different he might have fared better, but the Tibetans were then engaged in recruiting and raising levies to repel the Chinese advance on Lhasa by way of Chamdo, and as M. Bacot had a small Chinese escort, he was looked upon with suspicion. On his return to Tseku he passed through Lu-tze-kiang, where Père Genestier, a French missionary, resides. It was about five days to the south of this that the two German explorers, Dr. Brunhuber and Herr Schmitz, were recently assassinated by Lissu tribes (see *Journal*, vol. **34**, p. 608). According to M. Bacot, the Lissus who were captured and eventually executed by the Chinese were mere puppets who had nothing to do with the murders.

AFRICA.

Origin of the Nile Valley and Gulf of Suez.—It has of late years been regarded by geologists as an almost accepted fact that a portion at least of the Nile valley, with the gulf of Suez and even the Red sea itself, are rift-valleys of the type so fully developed further south in East Africa. This view is keenly contested in the February number of the *Geological Magazine* by Dr. John Ball, of the Egyptian Geological Survey, who puts forward arguments, based on field-work lately carried out by himself, for supposing that both the Gulf of Suez and the Nile valley are true valleys of erosion. From a careful examination of the Wadi Araba —a great valley some 20 miles wide draining north-eastwards into the Gulf of Suez —Dr. Ball has, he thinks, proved conclusively that this is an eroded anticline, and that the step-like structure observable in its limiting scarps is due to local slipping down of the hard upper strata of the cliff face. In the case of the Gulf of Suez the covering of its floor by water precludes such precise observation of its structure, but Dr. Ball shows that exactly similar, even if more restricted, observations can be made, tending to prove that it too is an eroded anticline, and that the faulting along its shores is purely land-slipping. An immense amount of erosion is involved by this view, but in the case of the Araba there can be no doubt that erosion on this immense scale has actually taken place. If the above is granted, an important support is removed from the rift theory in regard to the Nile valley, which has laid particular stress on the supposed analogy with the Gulf of Suez. One of the chief exponents of this theory has been Mr. H. J. L. Beadnell, whose argument depended mainly on the proved existence of bounding faults throughout a long stretch of the valley. Dr. Ball points out that no observation has ever been made of faulted-down rocks far from the scarps, and that here too the true explanation is that the faults are landslips. In this view Mr. Beadnell himself now concurs.

The Aboinia River, Southern Nigeria.*—The map given at the end of this number is reduced from a survey executed by Lieut. J. Burn, R.N.R., who writes: "The Aboinia river, sometimes called the Itenna creek, is a small river rising somewhere in the hills in the north-west of Southern Nigeria, though as yet it has not been followed to its source. It is a tributary of the Cross river, into which it empties itself 7 miles below Obutra hill, 120 miles from Culubur. During the month of December and thenceforward until the beginning of June, there is very little water in it, only enough to float small native canoes; but when it is cleared of snags, of which it is full, it will be a very useful waterway, enabling trade to be brought down from the Hinterland, and stores, etc., to be taken up to the new Government station at Abakaliki, especially during the wet season, as then the roads are impassable. The Aboinia has gradually sloping mud banks, with dense forests on both sides, with here and there a clearing, which is thickly covered with elephant grass. There are very few villages on the banks, except in one or two places where the ground is much higher, as the river rises 20 to 25 feet during the rains, overflowing its banks and inundating the country for miles round. The natives inhabiting this district are of the Ikwe and Ezza tribes—all pagans."

AMERICA.

Explorations in the Home of the Wood Bison.—Mr. Harry V. Radford, an American naturalist, sends us some interesting notes on his recent investigations regarding the rare wood bison of North-West Canada, the home of which is in the almost unknown area west of the Slave river and north of the lower Peace, which

* Map, p. 620.

forms probably the largest still unexplored tract in the whole of North America. Mr. Radford has made some extensive journeys in this region during the past year, studying the habits, habitat, and history of the wood bison, and making track surveys so far as possible. The routes followed in these journeys, made with pack-horses in summer and with dog-sledges in winter, had, down to January last, extended to a total of 1200 miles. No previous study of the wood bison in its native haunts had ever been made, the knowledge of the animal having depended solely on a mutilated skin, without skeleton, obtained by Indians some twenty years ago, and now in the Ottawa Museum. Mr. Radford has seen eighteen wild wood bison, and studied them at close range, so that he has acquired valuable information bearing on the question of the specific difference from, or similarity with, the bison of the southern plains. He had obtained from the Canadian authorities a permit (never before granted) to procure a specimen for scientific purposes, and was successful in shooting a magnificent bull, which was hunted down on snow-shoes after a long and exhausting chase. With the help of his Indians, the traveller was able, despite the temperature of −42° Fahr., to save the complete skin and skeleton, securing a full series of body measurements, photographs, colour record, etc. By weighing the animal piecemeal, with an accurate 200-lb. steelyard, Mr. Radford determined the total weight to be 2402 lbs.—exceeding by 302 lbs. the *estimated* weight of the largest bison previously known, that killed by Hornaday in Montana in 1886. Mr. Radford states that his observations show the vague indications of existing maps relative to this region to be largely incorrect, and further details of his work will therefore be awaited with interest.

The Boundary between Peru and Bolivia, as finally fixed by the treaty of September last (*Journal*, vol. **34**, p. 573), is shown on Major Fawcett's map at the end of this number. The section in dispute was that running from the Rio Suches, in about 14° 50′ S., to the Acre on the Brazilian frontier. According to the Argentine award of last summer, the line took a course between the Madre de Dios and the Acre considerably more to the advantage of Peru than that now decided on, as it followed the Madre de Dios some 40 miles (apart from windings) below the mouth of the Heath, before striking north-west and north to the Acre. Further south, on the other hand, the change has been slightly in favour of Peru, as the line now runs a little to the east of the upper Tambopata (originally laid down as the frontier) to its right bank tributary the Lanzas.* The text, both of the Argentine award and of the final treaty, is printed in a collection of documents issued last year at La Paz by the Bolivian Ministry of Foreign Affairs.

The Madeira and Mamore Railway.—An illustrated article in the *Bulletin of the International Bureau of the American Republics* for January last reports progress in the construction of this railway, long ago projected as a means of transit past the great falls of the Madeira. The first sod was cut at San Antonio in 1871. In 1878 a survey of 320 miles was made through the forest, and a train run for 4 miles. At the beginning of this year the railway was laid a distance of 46 miles, on which five engines were already running, and six more were on the way thither. The 320 miles of line cut and surveyed in 1878 were, in January last, shortened to 200 miles, and beyond the 46 miles over which trains were running, the 154 miles remaining to complete the line were graded and almost ready for the 1-metre gauge track. The country to be served by the railway will include the area drained by the Madeira and its affluents (of which the Mamore is the chief), equal to the area of Texas (262,000 square miles), and many thousand square miles

* By an oversight, the boundary is shown on our map as following the upper Tambopata, instead of veering eastward, as it should, to the Lanzas.

of contiguous territory in Eastern Bolivia, Peru, and Brazil, which have no outlet but the channels of the Madeira and Mamore, and which by the railway are destined to a commercial importance far outlasting the tin of the first, the copper of the second, and the diamonds of the third. Besides the rubber and cacao which the areas contiguous to the great rivers actually produce, and other tropical products they might easily produce, account has to be taken of the areas of equal fertility above the river-valleys, yielding chinchona, citron, coffee, cotton, and sugar, as also continuous pasture for cattle, while fertile valleys higher still on the mountain-side have in them the latent resources of great granaries. Altogether the railway will, it is claimed, do much for the development of a region of immense extent and resources.

The Natural Regions of the Argentine Republic.—An instructive study of this subject, from the pen of the late Señor E. A. S. Delachaux, appears in vol. 15 of the *Revista del Museo de la Plata*, and forms perhaps the best general sketch of the broad physical features of the Republic that we possess. After considering the various attempts at a subdivision of its surface into natural regions made by previous writers—De Moussy, Burmeister, Napp, and others—and pointing out certain reasons for disagreeing with their conclusions, the writer puts forward his own scheme, which consists in the definition of four main physical regions, further subdivided where necessary. In regard to the main regions, there has been a broad agreement among writers on the subject, who have all recognized the importance of the great longitudinal zones running from north to south through the country. It is in defining their limits and in their further subdivision according to latitude that Señor Delachaux's scheme (which takes account of meteorological, and to some extent of anthrogeographical, factors) differs from earlier ones. He defines the three longitudinal zones of the Republic—apart from Patagonia—as (1) the littoral, (2) the Mediterranean, (3) the Montane region. The term "littoral" is applied (as by former writers) in a somewhat conventional sense, as it is applied to the whole eastern zone, east of the meridian of Cordoba. It is marked by a general uniformity of soil and surface and by but slight climatic variations, and embraces the most fertile and important portion of the Republic. Señor Delachaux divides it into an eastern, a northern, and a southern section, the first corresponding to the Mesopotamian region of De Moussy, between the Paraná and Uruguay. Topographic, meteorologic, phytogeographic, and ethnographic considerations lead to the division of the remainder along a line running approximately from Cordoba to Santa Fé, the southern portion corresponding generally with the Pampas. The Mediterranean region forms, broadly speaking, a great depression running from north to south, to the west of the littoral region, and including the Salinas Grandes and other areas of inland drainage. Its position and other conditions give it a more or less arid character, unsuited to agriculture except in favoured localities. The local and seasonal differences of temperature are much more marked than in the first region. The Montane region of the west includes the area with an altitude varying from 300 to 6000 or even 7000 metres above the sea. Apart from small areas its climate is remarkably dry, and the great variations in temperature render its character more markedly continental than even that of the Mediterranean region. It may be divided into a northern and a southern sub-region, the former forming a tableland, mostly without drainage to the sea. Lastly, Patagonia (bounded to the north by the Rio Negro), in spite of its great extension in latitude, forms a remarkably homogeneous unit—a meseta, or platform, the portion of the Cordillera included being too small to form a distinct sub-region. Its climate is mild for the latitude (though spells of exceptionally severe weather occur), the reason being the close approach of the oceans on either side. With a scanty rainfall in the east and an excessive one in the west, it is the

intermediate zone which offers the most favourable conditions for development, and it is there that colonization has made the greatest advance. The study is illustrated by maps showing various distributions as well as the proposed scheme of subdivision.

AUSTRALASIA AND PACIFIC ISLANDS.

The Lost River Wairarapa, New Zealand.—The complete alteration of the configuration and drainage system of the east coast of New Zealand in the neighbourhood of Hawke bay, consequent upon a great volcanic convulsion at the close of the Pliocene period, is discussed by Mr. H. Hill in an article entitled "The Great Wairarapa: A Lost River," published in the *Transactions of the New Zealand Institute* for 1908. Formerly the coast-line extended farther eastward than at present, and numerous streams which now form different river-systems flowed south-eastward into a great river running for a considerable part of its course parallel with the coast. But great earth-movements at the close of the Pliocene period caused a large part of the coast to disappear beneath the sea, the Wairarapa river with it, and the present outline of the coast came into shape with the formation of Hawke bay, Poverty bay, and other inlets. Before this great topographical change took place the network of tributaries from the west bared the country of much of the limestone that then covered it, replacing it by those thick, heavy deposits of pumice and shingle which are now so characteristic of the country between the Kaimanawa mountains and Tauranga-Taupo. In Poverty bay, the Kaiti hills, and other regions there are to-day abundant facts to show what the country was like before the present plain and river-valley came to be. The new rivers, like the Tukituti, which suddenly became independent streams after the subsidence of the coast, effected very active denudation; and plains like those of Poverty bay and Wairoa have all been formed by means of the materials brought down by them in time of flood; and as the process still goes on Poverty bay may once more become dry land. The soil of these newly-formed lowlands is thus naturally rich and will repay cultivation.

POLAR REGIONS.

Dr. Charcot's Antarctic Expedition.—A letter has been received from Dr. Jean Charcot, despatched from Deception island in December last by a whaling vessel. Though written before the westward cruise on board the *Pourquoi Pas?* to 126° W. long., the letter supplements in an interesting manner the telegraphic account of the expedition's work which was published in the March number of the *Journal* (vol. 35, p. 337). Dr. Charcot warmly congratulates this country on Sir Ernest Shackleton's achievements, of which he had only just learned, and expresses the hope that Captain Scott will be successful in his attempt to reach the south pole. As regards his own expedition, though the results had not been all he had hoped for, a good deal of serious scientific work had been accomplished, and some new geographical facts brought to light. The expedition had experienced continuously bad weather, a north-east gale having been blowing almost without cessation from February to December. The ice conditions had been so bad that sledging had been very difficult and there had been no chance of giving a fair trial to the motor sledges. During the winter there had been a few cases of scurvy, and he himself had been badly attacked by myocarditis. Referring to Adelaide island, he writes: "This latter island is most interesting and curious. Biscoe considered it 8 miles in length, and it really is 70 miles in length; nevertheless, Biscoe's description is excellent in all respects, and his error is easily explained. I have taken the liberty of giving the name of Queen Alexandra to a previously

unknown part of Queen Adelaide's island. North of this island we have found and explored a large bay. Of all these coasts, including Alexander I. Land, Adelaide island, and the coast to the south, we have brought back good photographs. In fact, I can very nearly say we have taken the whole coast from Gerlache strait to the 69th parallel. Soundings have been taken regularly during our navigation. Unhappily, we have found it absolutely impossible to winter near Alexander Land or even Adelaide island. I think it is not possible to imagine a worse region for polar work—rocks, icebergs, heavy ice, no bottom for anchoring, no shelter, perpendicular cliffs of ice perpetually breaking to pieces, and hardly a corner here and there where to land. . . . Since we left our wintering quarters, we have been taking soundings, dredgings, geological specimens, etc., in the Shetlands, and my officers have done some good mapping work. This may interest more particularly your country, to whom this region belongs, and it may be particularly important, as the whaling business is going on on a large scale. Of course, all our work will be at the disposal of the Royal Geographical Society, and it may be useful, as we have found important errors even in the most recent Admiralty charts."

Scottish Antarctic Expedition.—It has been known for some time that Dr. Bruce proposes, if the requisite funds are forthcoming, to undertake a new expedition for scientific exploration in the Antarctic region. He has now issued a statement in which his plans are definitely outlined, accompanied by a map showing the route proposed to be followed. It is hoped that the expedition may sail about May 1, 1911, proceeding first to Buenos Aires, and thence steering a zigzag course to Cape Town, between 40° to 50° S., for the purpose of broadly completing the bathymetrical survey of the South Atlantic ocean begun by the *Scotia* in 1902–04. After refitting at Cape Town the expedition will sail for the Sandwich group, making further soundings *en route*, in order to test the existence of the "rise" supposed by Dr. Bruce to join the Sandwich group with Bouvet island. It will then steer for Coats Land, or some suitable spot in its neighbourhood, and here a party will be landed and a house erected. The ship will then proceed to Melbourne for the winter, carrying on deep-sea research *en route* in as high a latitude as possible. In the following spring it will proceed to McMurdo strait with a party whose task will be to push south with supplies, and endeavour to meet Dr. Bruce, who will meanwhile have set out from the base near Coats Land with a view to crossing the Antarctic Continent by way of the South Pole. Should these plans be successful, the combined parties would return to the ship and sail for New Zealand, afterwards carrying out further oceanographical work in the extreme south of the Pacific, and relieving the Coats Land party in the next spring.* The project is thus an ambitious one, and it is to be hoped that the funds urgently needed to secure a chance of success may be forthcoming.

The Proposed German Antarctic Expedition.—The proceedings at the meeting of the Berlin Geographical Society on March 5 have now been reported in the new number of the *Zeitschrift* of that Society, and it is thus possible to obtain a somewhat greater insight into the details of the project for a German Antarctic expedition under Lieut. Filchner (April number, p. 455). Besides the prospective leader, both Prof. O. Nordenskjöld and Prof. Penck addressed the meeting, dwelling especially on the importance of the problem of the relations between Eastern and Western Antarctica, to the solution of which Lieut. Filchner proposes to devote his chief energies. Prof. Penck summarized the argument (based in particular on the *régime* of the winds so far as known) which may be adduced in support of the view that the main mass of Antarctic land lies over against the eastern hemisphere, and that the great escarpment of South Victoria Land explored by Scott and Shackleton is continued rather in the direction of

ROYAL GEOGRAPHICAL SOCIETY

NEW PUBLICATION

MAPS
AND
MAP-MAKING

LECTURES DELIVERED UNDER THE AUSPICES OF THE ROYAL GEOGRAPHICAL SOCIETY

BY

E. A. REEVES, F.R.A.S., F.R.G.S.

MAP CURATOR AND INSTRUCTOR IN SURVEYING,
ROYAL GEOGRAPHICAL SOCIETY

WITH NUMEROUS ILLUSTRATIONS

LONDON
THE ROYAL GEOGRAPHICAL SOCIETY
1, SAVILE ROW, W.
1910

Price, to Fellows, 6s. net; to Non-Fellows, 8s. net.

Coats Land than Graham Land. According to this view, Western Antarctica, from Graham Land to King Edward VII. Land, will be rather of the nature of an island lying before the continental mass. The solution of the problem would be greatly forwarded by an attempt to trace the foot of the great escarpment across the unknown area, and though this might be done no doubt by an expedition starting from the Ross sea, the fact that south of 75° all on the side of the Weddell sea is unknown ground in the chosen longitude, gives a special importance to this region as a field for exploration. Whether the sledge party could continue its march to the opposite side of the Polar area would depend on the funds available, as in this case a second ship to take out a relief party by way of the Ross sea would be necessary. The offer, under certain conditions, of an anonymous contribution of £15,000 towards the expenses of the expedition was announced at the meeting.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Voyage of the "Michael Sars."—The oceanographical expedition undertaken by Sir John Murray in conjunction with Dr. Hjort and other Norwegian scientists sailed from Plymouth on April 9. As announced in the *Journal* for December last (p. 684), the expedition will proceed to the coast of Morocco, making oceanographical observations *en route*, and afterwards visiting the Azores and possibly crossing the Atlantic to Newfoundland.

Ground-water or Subterranean Rivers in the Karst.—In summing up (*La Géographie*, February, 1910) the results of various subterranean explorations lately carried out, the well-known cave explorer, Mr. E. A. Martel, points out that all these recent researches (with others of earlier date) tend to disprove the theory of Prof. Grund, put forward in his "Karsthydrographie" (*Penck's Geogr. Abhandlungen*, vol. 7, 1903), that there is a continuous sheet of "ground-water" at the base of the Karst limestones, nourished by the infiltrations which take place in the caverns and other typical features of the Karst. Among recent workers in this field, one of the most active is M. Perko, who has published the results of his explorations of 1904 and 1905 (the twelfth and thirteenth seasons devoted by him to underground work) in the *Mitteilungen* of the Vienna Geographical Society (1909, No. 6). M. Perko adheres to the orthodox view that true subterranean rivers flow beneath the Karst, and denies the existence of the underground sheet postulated by Prof. Grund. M. Martel takes in turn the five principal objections raised by the latter to the existence of underground rivers, and gives reason for believing that they are all untenable, being at variance with facts ascertained by speleological research.

GENERAL.

Oxford School of Geography.—The lecture and other arrangements at this school for Easter and Trinity Terms, 1910, have lately been issued. They include, as usual, courses of lectures by the Professor of Geography and other officials of the school, as well as a weekly practical class and other special tuition to be arranged with pupils. Some of the general university courses will also have a bearing on geography, and may be attended with advantage for the Diploma in Geography.

The Eleventh International Geological Congress.—A second circular issued in March, gives further details of the arrangements for this Congress (*Journal*, vol. **32**, p. 628; **34**, p. 220), particularly respecting the excursions which are to take place before and after the meeting. This has been definitely fixed to begin at Stockholm on August 18, the session terminating on the 25th. Among the subjects of wide interest put down for discussion those of most interest

to geographers are: (1) Changes of climate since the maximum of the last glaciation; (2) the resources and distribution of iron ore throughout the world; (3) the geology of the Polar Regions. In reference to the two first, a large amount of material has been collected under the auspices of the Executive Committee, and this will be printed before the meeting and will serve as the basis of the discussions. Seven excursions have been arranged to take place, simultaneously, before the meeting, and in view of the limited number of members who will be able to take part in these, those desirous of so doing are asked to send in their names as soon as possible. In considering such applications, preference will be given to professional geologists and specialists specially interested in the places to be visited. The longest of these first excursions will be that to Ice fjord, Spitsbergen, under the guidance of Mr. G. de Geer, and this will start on July 25, the return to Stockholm being fixed for August 17. The remainder of this group will be to various parts of Northern and Central Sweden. Only short excursions will be arranged to take place during the session, and the programme of these is not fixed definitely. Seven, to various parts of Southern Sweden, will take place after the session, as well as an extension of one of these, which will not be completed till September 13, most of the others being brought to a close considerably earlier. Arrangements have been made for the Second International Agro-Geological Conference to take place at Stockholm simultaneously with the Geological Congress. The general secretary of the latter is Prof. J. G. Andersson, the postal address being "Stockholm, 3."

The Seventeenth Congress of Americanists is to take place this year in two sections, the first at Buenos Aires from May 16 to 21, the second at Mexico city during September. The reason for this division is that both cities are this year celebrating the centenary of the Independence of their respective republics, and in honour of these events the Congress will be known as the "Centenary Congress." The general programme of proceedings will follow the lines laid down for previous meetings. In addition to the meeting of this Congress at Buenos Aires, arrangements have been made for the holding in that City, July 10 to 25, 1910, of an "International American Scientific Congress," which will be divided into eleven sections, covering the whole field of scientific research.

The Geographical Society of Neuchâtel celebrated the twenty-fifth anniversary of its foundation early in February with appropriate ceremonies, various foreign societies and institutions being represented by delegates. The public meeting took place in February 5 under the presidency of Prof. Dubied, who has been for twenty-four years president of the society. Six distinguished foreign geographers, including Sir E. Shackleton, Prof. W. M. Davis, and Captain Roald Amundsen, were named honorary members in honour of the event.

OBITUARY.

Alexander Agassiz.

The announcement of the death of the distinguished American oceanographer, Alexander Agassiz, will be received with wide regret. He died on March 28, at sea, as he was returning to America.

Alexander Agassiz, the only son of the distinguished Prof. Louis Agassiz and his first wife, Cecile Braun or Agassiz, was born at Neûchatel, Switzerland, on December 17, 1835. In 1848, when his father was elected to the Chair of Natural History in the Lawrence Scientific School at Harvard University, Cambridge, Mass

he went to the United States, and graduated in 1855 at Harvard, subsequently taking the degree of Bachelor of Science in Civil Engineering in 1857, and then studying chemistry. In 1859 he became assistant in the United States Coast Survey in California, making a collection of marine fishes for the Museum of Comparative Zoology at Cambridge, then under the charge of his father, and visited the principal mines of that State. On returning to Cambridge in 1860, he married Anna Russell, and in the same year he was appointed assistant zoologist at the Museum of Comparative Zoology. In 1865 he became interested in coal mining in Pennsylvania, but afterwards turned his attention to the copper-mines of Lake Superior, developing and acting as superintendent of the Calumet and Heckla Copper Mines, said to be the richest in the world, by means of which he amassed a fortune. In 1869 he went to Europe to study the principal museums, and on returning took up his duties as Assistant Curator of the Museum of Comparative Zoology, of which, after the death of his father in 1873, he became Curator, and held that post for eleven years. In 1874 he was appointed Director of the Anderson Summer School of Natural History on Penikese island, Buzzard's bay, on the coast of Massachusetts. In 1875 he made a survey of Lake Titicaca and examined the copper-mines of Peru and Chile, bringing back a large collection of Peruvian antiquities for the museum.

He visited H.M.S. *Challenger* at Halifax, Nova Scotia, in May, 1873, while on her famous cruise, and on her return to England he spent a winter in Edinburgh assisting Sir Wyville Thomson and Sir John Murray in sorting out the various groups of organisms for distribution among the specialists, and subsequently wrote the *Challenger* Report on the Echinoidea. In 1877 he began a long series of oceanography researches, taking part in the expeditions on board the steamers *Blake* and *Albatross*, and conducting explorations among the coral reefs of the world, chartering steamers for that purpose. Thus he visited the principal reefs of the West Indies, the Hawaiian islands, the Fiji islands, the Great Barrier reef of Australia, and the Maldives.

Having the means, he never hesitated to back up his opinion of what was worth doing by a free expenditure of funds, and it seems that between the years 1877 and 1900 he expended a sum exceeding £20,000 in aid of certain of the scientific departments of Harvard University. Among these objects may be mentioned the physical laboratory, the observatory, the college library, the botanic gardens, and the museum, the cost of publishing the volumes of the Memoirs and Bulletins of the Museum, the carrying on for twenty years the Newport Laboratory at Rhode island founded by him, the purchase of land for the erection of buildings, the purchase of books and of collections, and the payment of the costs of his various expeditions and coral reef investigations.

He had planned a trip among the East Indian islands for next winter, writing as follows in a private letter dated December 3 last: "I intended to go to Singapore, and see what I could do in the way of chartering a small steamer to make a cruise among the East Indian islands, and take the trip in the winter of 1910–11, or any time I found it best after consulting with the Dutch captains. I had all the necessary letters to the officials, but, alas! I had to give it up. The doctor advises a long sea-trip and rest in some warm climate, so I go to Alexandria direct from New York, and will squat in some good hotel in Luxor for a few weeks." He accordingly proceeded to Egypt, and left Cairo on his return journey on February 23, spending a few days in Rome and Paris, and reaching London on March 17.

Dr. Agassiz' work has been widely recognized, and the following distinctions are amongst those conferred upon him: Officer of the Légion d'Honneur de France, Knight of the Prussian Order pour le Mérite, Foreign Member of the Royal Societies of London and Edinburgh, of the Academies of Science of London, Paris, Berlin,

Vienna, Munich, Rome, Stockholm, and Copenhagen, Foreign Associate of the Institut de France, President of the National Academy of Sciences, Washington, and President of the American Academy of Arts and Sciences, Boston. The most recent honour conferred on him was the award of the Victoria Research Medal last year by the Royal Geographical Society of London.

Dr. Agassiz was a prolific writer on scientific subjects, his principal works being 'North American Acalephæ,' 1865; 'Marine Animals of Massachusetts Bay,' 1871; 'Revision of the Echini,' 1872–74; 'North American Starfishes,' 1877; 'Report on the Echini of the *Blake*,' 1883; 'Three Cruises of the *Blake*,' 1888; 'Contributions to American Thalassography,' 1888; 'Coral Reefs of the Hawaiian Islands,' 1889; 'Calamocrinus diomedæ,' 1892; 'General Sketch of the *Albatross* Expedition of 1891,' 1892; 'Reconnaissance of the Bahamas and Cuba in 1893,' 1894; 'Visit to the Bermudas in 1893,' 1894; 'Islands and Coral Reefs of Fiji,' 1899; 'Coral Reefs of the Tropical Pacific,' 4 vols., 1903; 'Coral Reefs of the Maldives,' 2 vols., 1903; 'Panamic Deep Sea Echini,' 2 vols., 1904; 'General Report of the *Albatross* Expedition of 1904–5,' 1906; and 'The Genus Colobocentrotus,' 1908; besides many others written in collaboration.

Dr. Agassiz was a thorough American, both in feelings and sentiment. He was not tender in his criticisms nor even-tempered when criticizing theories with which he disagreed or a line of conduct of which he disapproved, but no man was more appreciative of or more warmly supported sound scientific work and observation. During his recent visit to London he spoke of the various memoirs on marine organisms now being prepared by specialists in many parts of the world or in process of publication, these organisms having been collected during his various cruises. He will be greatly missed by all engaged in oceanographical research, especially those occupied with the zoological aspects of the subject.

At an early date he adopted views concerning the structure and origin of coral reefs opposed to those set forth by Charles Darwin, and he visited the various coral reef regions of the world with the object of making observations on this and allied subjects. It is well known that he had been for some time engaged on a general and popular account of coral islands, and he recently stated that he had written this book three times, but found it very difficult indeed to satisfactorily deal with the mass of information that had been collected. During the coming year, he stated, it was his intention to write this book for the fourth and last time, leaving out all criticism of the work of other observers, and stating exactly what he had himself observed and his own views.

I dined with him at the Berkeley Hotel, London, on the evening of March 20, and on the following evening he dined with Prof. Harmer, Sir John Jackson, and myself at the Ritz Hotel, London. On that day week news was received of his death on board the *Adriatic* on his way home, he having sailed on the 23rd. The cause of his death is up to the present unknown, but in London he seemed to be in vigorous health.

Mrs. Agassiz died many years ago. He has left behind him three sons, one of whom generally accompanied him in recent years on his voyages and travels.

The following is probably one of the last letters written by Dr. Agassiz :—

"The Berkeley Hotel, Piccadilly, W., March 17, 1910.

"My Dear Murray,

"I am very glad to hear you are to be here, and I'll be on the look-out for you on Sunday. Why can't you dine with me, and we can talk matters over, unless you are in a rush? My diagrams of Funafuti and other atolls are much like yours.

"Thank you very much for the Scotch Lake Surveys. What a fine piece of work!

"Always yours truly,

"(Signed) A. Agassiz."

John Murray.

CORRESPONDENCE.

Desert Sand-dunes.

Barna, Galway, April 5, 1910.

The perusal of Mr. Beadnell's paper and the study of his excellent photographs lead me to remind you that, in a communication I sent you on the desert west of Halfa,* I drew attention to two forms of sand-waves (?), viz. what I now hear are called barchans, and the tarbul (plu. terabil). I crossed two lines of the former west of Selima, and sighted a third; and besides saw a rocky plain covered with isolated dunes which, though equal in size, were not crescentic. When climbing the former I was obliged to go up the horns of the crescent, as the steep side was so perpendicular that no attempt could be made up it. At their foot I often found patches of scorched grass. The lines of barchans were about 3 miles wide, and the hollows between the crescent of one and the slopes of the other swept quite clear, showing rocks and stones in many cases. It would appear that there is a break in the line of barchans, unless they made a wide sweep westward of Terfaui. In the line from Sheb to Terfaui their place is taken by "terabil," the north side of which is covered with bush (selim or kitr); and in many brackish water lies quite near the surface. The line of these terabil is distinctly north-west, which points to the road to Kufra being along it. (Rohlfs indicated a road from the latter place to Selima.) I cannot remember musical sand—perhaps owing to the high wind which blew when I was there.

David Comyn.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1909–1910.

Twelfth Meeting, April 11, 1910.—Major Leonard Darwin, President, in the Chair.

Elections.—*F. Noel Ashley; Edward Cecil Barker; Fairfax Carlyle; Rev. Arthur Crean, M.A.; Joseph de Frenes; Terence Zetland Oung; Wm. Ronald Read (King's Dragoon Guards); Sir Benjamin Simpson, K.C.I.E.*

The paper read was—

"Across Africa from the Niger to the Nile." By Dr. Karl Kumm.

Thirteenth Meeting, April 18, 1910.—Major Leonard Darwin, President, in the Chair.

The paper read was—

"Glacier Exploration in the Eastern Karakoram." By Dr. T. G. Longstaff.

* *Journal*, vol. 31, p. 442.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Isvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps, Eastern—Lake. *Sitzb. K.A.W. Wien*, Abt. IIa. 117 (1908): 9–26. **Exner**

Ueber eigentümliche Temperaturschwankungen von eintägiger Periode im Wolfgangsee. Von Dr. Felix M. Exner. *Diagrams.*

Alps, Eastern—Lake. **Götzinger.**

Studien über das Eis des Lunzer Unter- und Obersees. Von Dr. Gustav Götzinger (Sonderabdruck aus Internationale Revue der gesamten . . . Hydrographie, Bd. II., 1909.) Leipzig, 1909. Size 9½ × 6½, pp. 386–396. *Diagrams and Illustrations.*

Austria—Carinthia *G.Z.* 15 (1909): 361–370. **Krebs.**

Das Klagenfurter Becken. Landeskundliche Skizze. Von Norbert Krebs.

Austria—Küstenland—Caves. *Globus* 96 (1909): 213–217. **Mühlhofer.**

Die Erforschung des Wasserschlingers von Dane bei St. Kanzian im Küstenlande. Zum Studium des Problems der Höhlenflüsse. Von Leutnant F. Mühlhofer. *Plan, Illustrations, and Section.*

See note in the Monthly Record (December, 1909, p. 679).

Austria—Tyrol. *M.G. Ges. München* 4 (1909): 1–96. **Mylius.**

Die geologischen Verhältnisse des Hinteren Bregenzer Waldes in den Quellengebieten der Breitach und der Bregenzer Ach bis südlich zum Lech. Von Dr. Hugo Mylius. *Maps, Sections, and Illustrations.*

Carpathians. *Sitzb. K.A.W. Wien*, I. Abt. 117 (1908): 713–818. **Lucerna.**

Glazialgeologische Untersuchung der Liptauer Alpen. Von Dr. Roman Lucerna *Map and Sections.*

Carpathians. *Sitzb. K.A.W. Wien*, I. Abt. 116 (1907): 871–982. **Uhlig.**

Ueber die Tektonik der Karpathen. Von V. Uhlig. *Map and Sections.*

Carpathians—Historical. *Globus* 95 (1909): 267–270; 357–360. **Seidel.**

Balsazar Hacquet als Karpathenforscher. Von H. Seidel.
B. Hacquet's Reisen in der Hohen Tatra. By the same.

Crete. *National G. Mag.* **20** (1909): 778–787. **Hall.**
Explorations in Crete. By Edith H. Hall. *Illustrations.*

Europe—Anthropology. *Globus* **96** (1909): 229–232. **Werth.**
Das geologische Alter und die stammgeschichtliche Bedeutung des Homo Heidelbergensis. Von Dr. Emil Worth.

Europe—Population. *J.R. Statistical Soc.* **72** (1909): 685–713. **Baines.**
The recent growth of population in Western Europe; an essay in International comparison. Presidential Address by Sir J. A. Baines.

France—Ancient Geography. *La G., B.S.G. Paris* **20** (1909): 73–98. **Martel.**
Géographie préhistorique de la France. Par E.-A. Martel.

France—Corsica. *Alpine J.* **24** (1909): 645–660. **Ouston.**
Nineteen Days in Corsica. By T. G. Ouston. *Illustrations.*

France—Dordogne. *Le Globe, Mém. S.G Genève* **48** (1909): 1–34. **Pittard.**
Découvertes préhistoriques dans la Dordogne: Stratigraphie de deux stations moustériennes. Par M. Eugène Pittard. *Illustration and Diagrams.*

France—Gascony. *B.S.G. Comm. Bordeaux* **32** (1909): 285–289. **Buffault.**
De l'origine prétendue marine des lacs du littoral de Gascogne. Par Pierre Buffault.

France—Hautes-Alpes. *La G., B.S.G. Paris* **20** (1909): 111–116. **Moisson.**
Mouvement de la population du département des Hautes-Alpes au XIX^e^ siècle. Par Paul Moisson.

France—Haute-Garonne. *C.R.A. Sc. Paris* **149** (1909): 1169–1171. **Martel.**
Sur l'hydrologie souterraine du massif de Penè-Blanque ou Arbas (Haute-Garonne). Par E.-A. Martel.

France—Historical. *B.S.G. Lille* **52** (1909): 193–211. **Demangeon.**
Les Voyages en France au XVII^e^ siècle. Par M. Demangeon. *Maps and Illustr.*

ASIA.

China—Yang-tse. *Abrégé B.S. Hongroise G.* **36** (1908): 117–128. **Halász.**
Jób v. Kompolthy auf dem Jang-tse-Kiang. Von Gyula v. Halász. *Illustrations.*

Chinese Empire. *B.S.G. Lille* **52** (1909): 79–91. **Ollone.**
Chine Occidentale (Thibet, Mongolie). Par M. le commandant d'Ollone. *Portrait and Illustrations.*

French Indo-China—Railways. *B.S.G. Com. Paris* **31** (1909): 697–718. **Aymé-Martin.**
Les chemins de fer du Laos. Par Aymé-Martin. *Sketch-map.*

India—Baluchistan. *Records Geol. Surv. India* **38** (1909): 189–215. **Vredenburg.**
Report on the geology of Sarawan, Jhalawan, Mekran and the State of Las Bela, principally from the point of view of economic development. By E. W. Vredenburg. *Map and Sections.*
See note, *ante*, p. 593.

India—Droughts. *Jahresb. G. Ethnogr. Ges. Zürich.* (1908–09): 221–255. **Wehrli.**
Ueber Dürren in Britisch-Indien. Ein Beitrag zur Wirtschaftsgeographie Indiens. Von Dr. Hans J. Wehrli. *Sketch-maps and Diagrams.*

India—Himalaya. **Workman.**
A study of Nieve Penitente in Himalaya. Paper No. 2. By William Hunter Workman. (Reprinted from the *Zeitschrift für Gletscherkunde*, May, 1909, with some additions.) London: Spottiswood & Co., 1909. Size 8½ × 6, pp. 28. *Illustrations. Presented by the Author.*
Nieves Penitentes in Himalaya. By Dr. William Hunter Workman. (Reprinted from the *Alpine Journal*, May, 1908.) London, 1908. Size 8½ × 5½, pp. 10. *Diagram and Illustrations. Presented by the Author.*

India—Historical. **Sainsbury.**
A calendar of the court minutes, etc., of the East India Company, 1640–1643. By Ethel Bruce Sainsbury, with an Introduction and Notes by William Foster. Oxford: Clarendon Press, 1909. Size 9 × 6, pp. xxx. and 408. *Price* 12*s.* 6*d. net. Presented by the India Office.*

India—Meteorology. *Sits. K.A.W. Wien*, Abt. IIa. 117 (1908): 555–618. **Hann.**
Die tägliche Variation der Windstärke auf den Berggipfeln in Südindien in ihrer Beziehung zer der täglichen Luftdruckschwankung. Von J. Hann.

Japan—Dairen.
Japan. Report for the year 1908 on the Trade and Navigation of the Port of Dairen (Dalny). (Diplomatic and Consular Reports, Annual, No. 4272, 1909.) London: Wyman & Sons, 1909. Size 9½ × 6, pp. 18. *Sketch-maps.*
See note in the February number, p. 196.

Japan—Volcanoes. *M. deuts. Ges. Ostasiens* 12 (1909): 47–77. **Friedlaender.**
Ueber einige japanische Vulkane. Von I. Friedlaender.

Malay Archipelago—Banda. **Witkamp.**
Ts. K. Nederland. Aardr. Genoots. 25 (1908): 288–303, 807–832; 26 (1909): 62–85.
De drie buiteneilanden der Banda-Groep: Roen, Ai, Rosengain; benevens Pº Pisang en Lontôr's noordpunt. Door H. Ph. Th. Witkamp. *Maps.*

Malay Archipelago—Buru. **Van der Miesen.**
Ts. K. Ned. Aardr. Genoots. 26 (1909): 214–263, 578–597.
Tochten op het eiland Boeroe (7 Febr.–16 Juli 1908). Door J. H. W. van der Miesen. *Map.*
Niewe tocht naar het eiland Boeroe (26 November 1908—14 Februari 1909). By the same.

Malay Archipelago—Celebes. **Niermeyer.**
Ts. K. Nederland. Aardr. Genoots. 26 (1909): 612–621.
De onderzeese vorm van Celebes. Door J. F. Niermeyer. *Map.*

Malay Archipelago—Mentawei Islands. **Neumann.**
Ts. K. Ned. Aardr. Genoots. 26 (1909): 181–213.
De Mentawei-eilanden. Door J. B. Neumann. *Map.*

Malay Archipelago—Sumatra. *Z. Ges. E. Berlin* (1909): 583–608. **Moszkowski.**
Reisen in Ost- und Zentral-Sumatra. Von Dr. Max Moszkowski. *Maps.*

Persia—Seistan. *Records Geol. Surv. India* 38 (1909): 216–229. **Vredenburg.**
Note on a hippurite-bearing limestone in Seistan, and on the geology of the adjoining region. By Ernest W. Vredenburg. *Map and Illustrations.*

Philippine Islands—Leyte. *Philippine J. Sc.* 4 (1909): 339–358. **Adams.**
Geological Reconnaissance of the Island of Leyte. With notes and observations on the adjacent smaller islands and south-western Samar. By George J. Adams. *Sketch-map.*

Philippine Islands—Luzon. *Philippine J. Sc.* 4 (1909): 483 487. **Ickis**
A Geological Reconnaissance from Infanta, Tayabas, to Tanay, Rizal. By H. M. Ickis. *Sketch-map and Section.*

Russian Central Asia. *J.R. Asiatic S.* (1910): 111–128. **Beveridge.**
The Babar-nama Description of Farghana. By Annette S. Beveridge.
A revised translation of Babar's account of Ferghana, with notes.

Russian Central Asia—Lakes. *Ann. G.* 18 (1909): 407–415. **Shokalsky.**
Le niveau des lacs de l'Asie Centrale russe et les changements de climate. Par J. de Schokalsky. *Sketch-map and Diagrams.*

Siam—Phytogeography. *Globus* 96 (1909): 149–152, 167–170. **Hosseus.**
Vegetationsbilder aus Siam. Von Dr. C. C. Hosseus. *Illustrations.*

Turkey—Arabia—Railway. *Ann. G.* 18 (1909): 416–432. **Bonin.**
Le chemin de fer du Hedjaz. Par Charles-Eudes Bonin.

Turkey—Mesopotamia. *B.S.G. Italiana* 10 (1909): 740–753. **Lanzoni.**
La Mesopotamia. Del dott. Adriano Lanzoni.

Turkey—Syria. *G.Z.* 15 (1909): 571–589. **Banse.**
Syrische Fragmente. Von Ewald Banse. *Illustrations.*

Turkey—Syria. *Travel and Exploration* 2 (1909) 348–353. **Salmon.**
Off the Beaten Track in Syria. A description of a journey through a little-known part of the Maronite and Druse Country. By P. R. Salmon. *Illustrations.*

AFRICA.

Abyssinia—Phytogeography. Rosen.

Vegetationsbilder (*Karsten und Schenck*) 7 (1909): *Plates* 25-30.

Charakterpflanzen des abessinischen Hochlandes. Von Felix Rosen. *Illustrations.*

British East Africa—Survey.

Survey Department of British East Africa. Annual Report for the year ending March 31, 1909. Mombasa and Nairobi, [1909]. Size 10 × 7, pp. 20. *Diagrams. Presented by the Survey Department.*

British South Africa. Hodson.

A Trek in the Unknown Country North of the Makalakari. By Arnold W. Hodson. (Extract from the *Empire Review*, vol. 18, No. 104, 1909.) London, 1909. Size 9½ × 6½, pp. 106–113. *Presented by the Author.*

Makalakari is the salt pan more generally known as Makarikari. The country to the north hardly deserved the epithet unknown, as it had been crossed in various directions by Selous and others.

Cape Colony—Geology. *Cape of Good Hope, Geol. Com.* 13 (1908): 9–109. Rogers.

Report on the Geology of Parts of Prieska, Hay, Britstown, Carnarvon, and Victoria West. By A. W. Rogers and A. L. du Toit. *Plans and Sections.*

Cape Colony—Knysna. *Cape of Good Hope, Geol. Com.* 13 (1908): 129-134. Rogers.

Note on a journey to Knysna. By A. W. Rogers. *Sketch-map.*

Central Sudan. *C.R.A. Sc. Paris* 149 (1909): 646-648. Tilho.

Sur l'existence probable d'un centre très accentué de basses pressions dans la région du Tchad, d'après les observations de la Mission Niger-Tchad. Par Capitaine Tilho.

East Africa—Historical. *Rendiconti R.A. Lincei* 18 (1909): 49–75. Schiaparelli.

La geografia dell' Africa orientale secondo le indicazioni dei monumenti egiziani. Del Ernesto Schiaparelli.

Egypt—Atmospheric Electricity. Hurst.

Ministry of Finance, Egypt. Survey Department Paper, No. 10. A Discussion of the Observations on Atmospheric Electricity at Helwan Observatory. From March, 1906, to February, 1908. By H. E. Hurst. Cairo, 1909. Size 11 × 7½, pp. 66. *Map, Plan, and Diagrams.*

Egypt—Irrigation.

Public Works Department. Reports upon the Administration of the Irrigation Services in Egypt and the Sudan for the year 1908. Cairo, 1909. Size 11 × 7½, pp. 86. *Maps, Diagrams, and Illustrations. Presented by the Director-General.*

Egypt—Nile Valley. *Cairo Sc. J.* 3 (1909): 250–252. Ball.

The Origin of the Nile valley and the Gulf of Suez. By Dr. John Ball.

Noticed in the Monthly Record, *ante*, p. 596.

Egypt—Survey. Hume.

Ministry of Finance, Egypt. Survey Department Paper, No. 20. The Distribution of Iron Ores in Egypt. By W. F. Hume. Cairo, 1909. Size 10½ × 7½, pp. 16. *Sketch-map. Presented by the Director-General.*

Eritrea—Communications. *Riv. Col.* 6 (1909): 526–539. Cortinois and Cucinotta.

Vie di comunicazione e mezzi di trasporto della Colonia eritrea. Dott. A. Cortinois ed E. Cucinotta.

French Congo. *La G., B.S.G. Paris* 19 (1909): 353–366. Bruel.

Les basses vallées de l'Oubangui et de la Sanga. Par G. Bruel.

French Guinea. *L'Afrique Française* 19 (1909): 418–420. Salesses.

Carte démographique de la Guinée. Par E. Salesses. *Sketch-map.*

The map shows the estimated density of population by "circles" (see p. 452, *ante*).

French Guinea. *B.S. Languedoc. G.* 32 (1909): 25–68. Viala.

Exploration en Haute-Guinée (Afrique Occidentale). Par L. Fernand Viala.

The writer's chief object was the examination of the mining district of Sigiri.

French West Africa. *La G., B.S.G. Paris* **19** (1909): 337–352. **Chevalier**
La région des sources du Niger. Mission scientifique de l'Afrique Occidentale Française (1909). Par Auguste Chevalier. *Sketch-map.*

French West Africa—Upper Gambia. *L'Afrique Française* **19** (1909): 339–342. ——
La Navigabilité de la Gambie en amont de la frontière anglaise. *Map.*

German East Africa—Gold. **Tornau**
Berichte Land- u. Forstwirtschaft Deutsch-Ostafrika **2** (1905): 265–282.
Die Goldvorkommen Deutsch-Ostafrikas, insbesondere Beschreibung der neu entdeckten Goldgänge in der Umgegend von Ikoma. Von Dr. F. Tornau. *Plan and Diagrams.*

German South-West Africa. *Deutsches Kolonialblatt* **21** (1910): 54–59. ——
Die Expedition Streitwolfs nach dem Caprivi-Zipfel.

Gold Coast—Forestry. **Thompson**
Gold Coast. Report on Forests. By H. N. Thompson. (Colonial Reports, Miscellaneous, No. 66, 1910.) Size 9½ × 6, pp. 238. *Sketch-map and Illustrations.*

Italian Somaliland. *J. African S.* **9** (1909): 59–72. **Baldacc**
The Promontory of Cape Guardafui. By Giulio Baldacci.

Italian Somaliland. *Rev. Col.* **6** (1909): 485–514. **Coe**
La seconda colonia italiana, Il Benadir. Del Professore Gustavo Coen.

Liberia. *Globus* **96** (1909): 234–240, 245–251. **Scherer**
Liberianische Küstenfahrten und Urwaldwanderungen. Von Josef Scherer.

Madagascar. ——
Gouvernment Général de Madagascar et Dépendances. Statistiques Générales, 1907. Melun, 1908. Size 14 × 11, pp. 398. *Presented by the Governor-General.*

NORTH AMERICA.

Alaska—Yakutat Bay. **Tarr and Butl**
U.S. Geol. Surv. Prof. Paper **64** (1909): pp. 184.
The Yakutat Bay Region, Alaska. Physiography and Glacial Geology. By Ralph S. Tarr. Areal Geology. By Ralph S. Tarr and Bert S. Butler. *Maps, Sections, and Illustrations.*

Canada—Anticosti. *Questions Diplomatiques* **28** (1909): 657–664. **Dewavr**
La colonisation de l'île d'Anticosti. Par Maurice Dewavrin. *Sketch-map.*

Canada—Coalfields. **Dowli**
Canada, Department of Mines Geological Survey. The Coal-fields of Manitoba Saskatchewan, Alberta, and Eastern British Columbia. By D. B. Dowling Ottawa, 1909. Size 10 × 6½, pp. 112. *Map, Diagrams, and Illustrations.*

Canada—Geology. **Young and Bro**
Canada. Department of Mines. Geological Survey. A Descriptive Sketch of th Geology and Economic Minerals of Canada. By G. A. Young. Introduction b R. W. Brock. Ottawa, 1909. Size 9½ × 6½, pp. 146. *Maps and Illustrations.*

Canada—Maritime Provinces. **Matth**
P. and T.R.S. Canada (3rd Ser.) **2** (1908): Sec. IV., 121–143.
Geological Cycles in the Maritime Provinces of Canada. By G. F. Matthew.

Canada—Ontario. **Wilson and Coll**
Canada. Department of Mines. Geological Survey. Reports on a portion Algoma and Thunder Bay Districts, Ontario. By W. J. Wilson. And on th Region lying North of Lake Superior between the Pic and Nipigon Rivers, Ontari By W. H. Collins. Ottawa, 1909. Size 10 × 6½, pp. 46 and 24. *Map a Illustrations.*

Canada—Resources. **Yo**
Canada's Fertile Northland. Evidence of Mr. R. E. Young . . . before the Sele Standing Committee on Agriculture and Colonization, 1907–8. Ottawa, 19(Size 9½ × 6½, pp. 143–190. *Map.*

Canada—Survey. **McCon**
Canada. Department of Mines. Geological Survey. The Whitehorse Copp

Belt, Yukon Territory. By R. G. McConnell. Ottawa, 1909. Size 10 × 6½, pp. 64. *Maps, Sections, and Illustrations.*

Mexico—Boundary. *B.S.G. y Estadistica Rep. Mexicana* (5) 3 (1909): 145–156. **Ponce.**
Nuestros límites con los Estados Unidos del Norte. Discurso de recepción del socio Sr. Francisco de P. Ponce.
A sketch of the History of the Boundary.

Mexico—Zacatecas. *Popular Sc. Monthly* 75 (1909): 435–451. **Kirkwood.**
Desert scenes in Zacatecas. By Prof. J. E. Kirkwood. *Sketch-map and Illustr.*

Newfoundland and Jamaica—Minerals. **Outerbridge.**
J. Franklin I. 168 (1909): 457–469.
The Mineral Wealth of the Islands of Newfoundland and Jamaica. By A. E. Outerbridge. *Illustrations and Sections.*

North America—Historical. *Popular Sc. Monthly* 75 (1909): 313–337. **Kunz.**
The Hudson-Fulton Celebration of 1909. By Dr. George Frederick Kunz. *Portraits and Illustrations.*

North America—Forests. *Popular Sc. Monthly* 75 (1909): 370–392. **Trotter.**
The Atlantic Forest Region of North America. By Spencer Trotter.

United States. *National G. Mag.* 20 (1909): 573–580. **Zon.**
When Our Country is Fifty Years Older. By Raphael Zon. *Sketch-map and Illustrations.*
Forecasts the future of the economic resources of the United States.

United States—Arizona. *Science* 30 (1909): 720–724. **Blumer.**
On the Plant Geography of the Chiricahua Mountains. By J. C. Blumer.

United States—Arizona. *Monthly Weather Rev.* 37 (1909): 225–237. **Douglass.**
Weather Cycles in the Growth of Big Trees. By Prof. A. E. Douglass.
Noticed in the Monthly Record, March, p. 335.

United States—California. *Z. Ges. E. Berlin* (1909): 609–616. **Klautzsch.**
Das Kalifornische Erdbeben vom 18. April 1906. Von Dr. A. Klautzsch.

United States—Colorado. **George.**
Colorado Geological Survey: First Report, 1908; with accompanying papers. R. D. George, State Geologist. Denver, 1909. Size 9 × 6, pp. vi. and 244 *Maps and Illustrations.*

CENTRAL AND SOUTHERN AMERICA.

Argentine. *Rev. Museo La Plata* 15 (1908): 102–131. **Delachaux.**
La regiones físicas de la República Argentina. Por Enrique A. S. Delachaux. *Maps.*
Noticed *ante*, p. 598.

Argentine—Archæology. *Rev. Museo La Plata* 15 (1908): 138–197. **Outes and others.**
Estudio de las supuestas "escorias" y "tierras cocidas" de la serie pampeana de la República Argentina. Por Felix F. Outes, Dr. Enrique Herrero Ducloux y Dr. H. Bücking. *Diagrams and Illustrations.*

Brazil—Diamond Fields. *J.R.S. Arts* 58 (1909): 101–129. **Pearson.**
The Diamond Fields of Brazil. By Hugh Pearson. *Sketch-maps.*

Brazil—Para. *La G., B.S.G. Paris* 20 (1909): 99–110. **Ducke.**
Explorations dans le nord de l'état de Para. Par A. Ducke.

Brazil—Rainfall. *Ministerio da Industria, etc. (Brazil), B.* 1 (1909): 139–144. **Voss.**
As chuvas no nordeste da Brazil. Pelo Dr. Ernest Ludwig Voss. *Sketch-maps and Diagram.*

Brazil—Rio S. Francisco. **Williams.**
Ministerio da Industria, etc. (Brazil), B. 1 (1909): 111–137.
Agro-Geologia do Valle do S. Francisco. Por Horacio F. Williams. *Sketch-maps, Sections, and Diagrams.*

Brazil—Water Supply. **Branner.**
Ministerio da Industria, etc. (Brazil), B. 1 (1909): 83–110.
O problema das seccas do Norte do Brazil. Por J. C. Branner. *Sketch-map and Sections.*

Chile—Patagonia. *G.Z.* **15** (1909): 511–520, 558–571. **Steffen.**
Studien über West-Patagonien. Von Hans Steffen. *Map.*

Chile—Surveys.
Republica de Chile. Segunda memoria del director de la Oficina de Mensura de Tierras pasada al Señor Ministro de Colonizacion en Abril de 1909. Santiago, 1909. Size 11 × 7½, pp. 136. *Maps and Illustrations. Presented by the Oficina de Mensura de Tierras, Chile.*

Chile—Volcano. *Rev. Museo La Plata* **15** (1908): 49–53. **Ducloux.**
Nota sobre la ceniza del volcán Rininahue. Por Dr. Enrique Herrero Ducloux. *Diagrams.*

Chile—Volcano. *Z. Ges. E. Berlin*, 1909: 332–334. **Lütgens.**
Ueber den Ausbruch des Vulkans Vallarica in Süd-Chile. Von Dr. Rudolf Lütgens. *Sketch-map.*

AUSTRALASIA AND PACIFIC ISLANDS.

New Guinea—Dutch. *Ts. K. Ned. Aardr. Genoots.* **26** (1909): 946–965. **Rambonnet.**
De jongste opvaart der Mambèràmo, 23 Juni—9 Juli 1909. Door F. L. Rambonnet.

New Guinea—Dutch. *Ts. K. Ned. Aardr. Genoots.* **26** (1909): 86–128. **Rouffaer.**
De drie opvaarten der Mambèràmo (Noord Nieuw-Guinea), Juli 1884, Jan. 1900 en Juni 1906. Door G. P. Rouffaer. *Map and Illustrations.*

New South Wales—Coast. *J. and P.R.S. New South Wales* **42** (1908): 229–237. **David**
Evidence of Recent Submergence of Coast at Narrabeen. By S. W. Edgeworth David. *Sections.*

New South Wales—Geology. **Jensen**
J. and P.R.S. New South Wales **42** (1908): 299–310.
Some Geological Notes on country behind Jervis bay. By H. I. Jensen.

New Zealand—Commercial. *B.G.S. Philadelphia* **8** (1910): 17–31. **Marshall**
The Commercial Geography of New Zealand. By P. Marshall. *Sketch-maps and Illustrations.*

New Zealand—Forestry. **Kensington**
New Zealand, 1909. Department of Lands. Forestry in New Zealand. By William C. Kensington. Wellington, 1909. Size 13 × 8½, pp. 118. *Maps and Illustrations. Presented by the Author.*

New Zealand—Otago. **Baughan**
The Finest Walk in the World By B. E. Baughan. London: Whitcombe & Tombs, [N D., 1909?]. Size 7½ × 5½, pp. 36. *Illustrations. Presented by the Author*

New Zealand—Physical. *B.G.S. Philadelphia* **8** (1910): 1–16. **Bel**
The Physical Features of New Zealand. By Dr. J. M. Bell. *Illustrations.*

New Zealand—Scenery. **Department of Land**
New Zealand: Department of Lands. Reports on scenery preservation for the years 1906–7 (pp. 38), 1907–8 (pp. 16), and 1908–9 (pp. 16). By William C Kensington. Wellington, 1907–09. Size 13½ × 8½. *Maps and Illustrations.*

New Zealand—Stewart Island. **Cockayn**
New Zealand: Department of Lands. Report on a botanical survey of Stewart island. By Dr. L. Cockayne. Wellington, 1909. Size 13 × 8½, pp. 68. *Map and Illustrations.*

POLAR REGIONS.

Arctic—Meteorology. **Wegen**
Drachen- und Fesselballonaufstiege ausgeführt auf der Danmark-Expedition 1906–1908. Von Alfred Wegener. (From *Meddelelser om Grønland*, Bind 42) Copenhagen, 1909. Size 11 × 7, pp. 76. *Illustrations and Diagrams.*

Arctic—Norwegian Expedition. *Norske G.S. Aarbog* **20** (1909): 55–75. **Amundse**
Plan for en Polarfærd 1910–1917. Af Roald Amundsen.

Greenland. **Steenstr**
Geologiske og antikvariske Iagttagelser i Julianehaab Distrikt. Af K. J. V. Steenstrup. (Særtryk af *Meddelelser om Grønland*, 34.) Copenhagen, 1909. Size 9 × 6, pp. 115–154. *Illustrations and Sketch-map.*

Polar Exploration. *Popular Sc. Monthly* **76** (1910): 89–97. **Reid.**
How could an Explorer find the Pole? By Prof. Harry Fielding Reid. *Diagrams.*
On the fixing of position in the neighbourhood of the pole.

Spitsbergen—Geology. *Norske G.S. Aarbog* **20** (1909): 1–8. **Holmsen.**
Lidt om Spitsbergens geologi. Av Gunnar Holmsen. *Map.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geomorphology—Deserts. *G.Z.* **15** (1909): 545–558. **Penck.**
Die Morphologie der Wüsten. Von Albrecht Penck.

Geomorphology—Dunes. *Ts. K. Nederland. Aardr. Genoots.* **26** (1909): 896-910. **Dubois.**
Over het ontstaan van de vlakten in het duin. Door Eug. Dubois.

Geophysics. *Deutsche G. Blätter* **32** (1909): 78–80. **Nölke.**
Ueber Simroths neue Begründung der Pendulationstheorie. Von Dr. Fr. Nölke.

Glacial Erosion. *C.R.A. Sc. Paris* **149** (1909): 1413–1415. **Martonne.**
Sur l'inégale répartition de l'érosion glaciaire dans le lit des glaciers alpins. Par Em. de Martonne.
See March number, p. 338.

Glaciers. *M.G. Ges. München* **4** (1909): 97–126. **Crammer.**
Struktur und Bewegung des Gletschereises. Von Prof. Dr. Hans Crammer. *Illustrations.*

Gravity. *Z. Ges. E. Berlin* (1909): 361–378. **Hecker.**
Die Schwerebestimmung an der Erdoberfläche und ihre Bedeutung für die Ermittelung der Massenverteilung in der Erdkruste. Von Prof. Dr. O. Hecker. *Maps, Illustrations, and Diagrams.*
Noticed in vol. **34**, p. 432.

Ground Temperature. *T. Edinburgh Geol. S.* **9** (1909): 167–178. **Anderson.**
On the Temperature Gradients of Deep Bores, with special reference to those of the Balfour Bore, Cameron Bridge, Fifeshire. By E. M. Anderson. *Diagram and Sections.*

Hydrology—Temperature. *Scottish G. Mag.* **25** (1909): 591–597. **Wedderburn.**
Temperature oscillations in lakes and in the ocean. By E. M. Wedderburn. *Sketch-map.*

Magnetism. *Terrestrial Magnetism* **14** (1909): 131–136. **Craig and Bauer.**
The Non-Magnetic Gas Engine of the *Carnegie*. By James Craig. The Launching of the *Carnegie* and the Departure of the *Carnegie* on her First Cruise. By Mrs. L. A. Bauer. *Plans and Illustrations.*

Meteorology. **Hildebrandsson.**
K. Svenska Vetenskaps-A. Handlingar **45** (1909): No. 2, pp. 12.
Quelques recherches sur les centres d'action de l'atmosphère. Par H. H. Hildebrandsson. III. Sur la compensation entre les types des saisons simultanés en différentes régions de la terre. *Diagrams.*

Meteorology. *Quart. J.R. Met. S.* **35** (1909): 233–248. **Rawson.**
The anticyclonic belt of the Northern hemisphere. By Colonel H. E. Rawson.
The writer had previously dealt with the corresponding belt of the Southern hemisphere (see also *Journal*, vol. **32**, p. 178).

Meteorology—Clouds. *Sitzb. K.A.W. Wien*, Abt. IIa. 117 (1908): 217-229. **Obermayer.**
Die Häufigkeitszahlen der Bewölkung. Von Albert v. Obermayer.

Meteorology—Instruments. ———
A barometer Manual for the use of seamen; with an appendix on the Thermometer, Hygrometer, and Hydrometer. Issued by the Authority of the Meteorological Committee. 6th edit. London: Wyman & Sons, 1909. Size 9½ × 6, pp. 68. *Charts, Illustrations, and Diagrams. Price* 3*d.*

Meteorology—North Atlantic. *Ann. Hydrographie* **37** (1909): 481–489. **Grossmann.**
Das Ergebnis der Versuche mit dem Bezuge von Wetter-Funkentelegrammen vom Nordatlantischen Ozean. Von [L.] Grossmann.

Meteorology—Temperature and Humidity. *Met. Z.* **44** (1909): 390–396. **Schubert.**
Ueber die Feuchtigkeit und Temperatur der Luft im Gebirge und in der freien Atmosphäre. Von Johannes Schubert. *Diagrams.*

Meteorology—Pressure. **Omori.**
B. Imp. Earthquake Investigation Com. **3** (1908): 215–222.
Note on the Long-period Variations of the Atmospheric Pressure. By F. Omori. *Charts and Diagrams.*

Meteorology—Upper Air. *P. American Phil. S.* **48** (1909): 8–33. **Blair.**
The Exploration of the Upper Air by means of Kites and Balloons. By William R. Blair. *Chart, Diagrams, and Illustrations.*

Meteorology—Upper Air. *B. Mount Weather Observatory* **2** (1909): 1–18. **Humphreys.**
Vertical temperature gradients of the Atmosphere, especially in the region of the Upper Inversion. By W. J. Humphreys. *Diagrams.*

Oceanography—Indian Ocean. **Czapek.**
Sitzb. A.W. Wien, Abt. I. **118** (1909): 231–240.
Zur Kenntnis des Phytoplanktons in Indischen Ozean. Von F. Czapek. *Illustrations.*

GENERAL.

Geography. *Scottish G. Mag.* **25** (1909): 617–635. **Lyons.**
The Scope of Modern Geography. By Captain H. G. Lyons. *Also separate copy* (9½ × 6, pp. 617–635), *presented by the Author.*

Glasgow University. **Coutts.**
A history of the University of Glasgow, from its foundation in 1451 to 1909. By James Coutts. Glasgow: J. MacLehose & Sons, 1909. Size 10 × 7, pp. xii. and 616. *Portraits and Illustrations. Price* 21*s. net. Presented by the University of Glasgow.*

Library Catalogue. **Wright**
Subject-Index of the London Library, St. James's Square, London. By Dr. C. L. Hagberg Wright. London: Williams & Norgate, 1909. Size 11 × 8, pp. xxviii. and 1254. *Presented by the London Library.*

This great undertaking, involving difficulties of no ordinary kind, seems to have been carried through with a large measure of success. It will be most valuable for reference.

Mountain Ascents. *National G. Mag.* **20** (1909): 493–530 **Fay.**
The World's Highest Altitudes and First Ascents. By Charles E Fay. *Illustrations.*

North Pacific—Coasts. **Niedeck**
Cruises on the Bering Sea; being records of further sport and travel. By Paul Niedeck. London: Rowland Ward, 1909. Size 9½ × 6½, pp. xvi. and 252. *Maps and Illustrations. Price* 21*s.*

Photography—Diary.
The Wellcome Photographic Exposure Record and Diary, 1910. London: Burroughs Wellcome & Co. Size 5½ × 3, pp. 280. *Illustrations. Presented by the Publishers.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria. **Freytag**
Karte des politischen Bezirkes Hietzing-Umgebung. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Vienna: G. Freytag & Berndt, [1910]. *Presented by the Publisher.*

Austria. **Freytag.**

G. Freytag's Generalkarte von Dalmatien, Bosnien und der Hercegovina. Scale 1:600,000 or 1 inch to 9·5 stat. miles. Vienna: G. Freytag & Berndt, [1910]. *Price 4 kr. Presented by the Publishers.*

Austria-Hungary. **Freytag.**

Dislokationskarte des k. u. k. österr.-ungar. Heeres, der Landwehren und der Gendarmeriekorps im Jahre 1910. Scale 1:1,800,000 or 1 inch to 28·4 stat. miles. Vienna: G. Freytag & Berndt, 1910. *Price 4 kr. Presented by the Publishers.*

Austria—Vienna. **Freytag.**

G. Freytag's Verkehrsplan der k. k. Reichshaupt- und Residenzstadt Wien. Mit Plan und Strassenverzeichnis des XXI. Bezirkes Floridsdorf. Scale 1:15,000 or 4·2 inches to 1 stat. mile. Vienna: G. Freytag & Berndt, 1910. *Price 1.50 kr. Presented by the Publishers.*

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from March 1 to 31, 1910.

County Diagrams, showing Unions, Sanitary Districts, Boroughs, and Civil Parishes. *Price 3s. each.* (1:2500 scale sheet-lines are now omitted, and the boundaries have been recently revised.)

1-inch—(third edition):—

In outline, 160, 197. *Price 1s. each (engraved).*
With hills in brown or black, 160, 197. *Price 1s. each (engraved).*
Large Sheet Series, printed in colours, folded in cover or flat in sheets, 59, 72, 82, 93, 132, 142. *Price, on paper, 1s. 6d.; mounted on linen, 2s.; mounted in sections, 2s. 6d. each.*

6-inch—County Maps:—

With contours in black.

Hampshire, 7 sheets. Kent, 18 sheets. Lancashire, 1 sheet. Lincolnshire, 1 sheet. Yorkshire, 40 sheets. *1s. each.*

25-inch—County Maps —

Cheshire, 18 sheets. Hampshire, 39 sheets. Lancashire, 12 sheets, Sussex 25 sheets. Yorkshire, 57 sheets *3s each.* And Geological Addenda.
(*E. Stanford, London Agent.*)

British Isles—England and Wales. **Geological Survey.**

4 miles to 1 inch:—

New Series, colour printed. Fishguard, Haverfordwest, Milford; sheet (13 and part of 17). Birmingham, Northampton, Gloucester, Oxford, Worcester (Solid edition), sheet 15. *Price 2s. 6d. each.*

1-inch map:—

New Series, colour printed. Drift edition. Stockton, Darlington, Middlesbrough, Yarm. (Old Series, sheet 103 S.E.) Sheet 33 *Price 1s. 6d.*
(*E. Stanford, London Agent.*)

British Isles—Scotland. **Bartholomew.**

Bartholomew's "Quarter-Inch-to-mile" map of Scotland. Sheets: 5, Forth and Tay; 6, Border Country; 7, Galloway and Lower Clyde. Edinburgh: John Bartholomew & Co., 1910. *Price 2s. each sheet net. Presented by the Publishers*

Reduced from Bartholomew's well-known excellent half-inch maps. The generalization of physical features and selection of names has been carefully carried out, and in some respects, specially as regards the colour tinting of the lower lands, the style in which the sheets are produced is an improvement on those on the larger scale. They are remarkably clear, and should be most useful to motorists and tourists generally.

Europe. **K. Preuss. Landesaufnahme.**

Uebersichtskarte von Mitteleuropa. Bearbeitet in der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1:800,000 or 1 inch to 4·7 stat. miles. Sheets: Cassel; Cöln; Antwerpen; Düsseldorf; Erfurt; Gent; Halle; Magdeburg; Neustrelitz; Prag; Rostock. Berlin: R. Eisenschmidt, 1905–07. *Price 1.50 m. each sheet.*

Germany. **Gravelius.**

Binnenschiffahrtstrassen im Deutschen Reich im Hinblick auf die Frage der

Schiffahrtsabgaben. [Von Prof. Dr. H. Gravelius.] Scale 1 : 3,760,000 or 1 inch to 58·4 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 21. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

ASIA.

Asia. **Military Topographical Dept., St. Petersburg.**

Map of the Southern Frontier Regions of Asiatic Russia. [In Russian.] Scale 1 : 1,168,031 or 1 inch to 18·4 stat. miles. Revised sheets: XIV. Urga; XXI. Hami; XXIII. Kaifeng. St. Petersburg: Military Topographical Department, 1908–09.

Asia. **Service Géographique de l'Armée, Paris.**

Carte de l'Asie. Scale 1 : 1,000,000 or 1 inch to 15·7 stat. miles. Sheet: Teheran. Paris: Service Géographique de l'Armée, 1908. *Price* 1.25 *fr. each sheet.*

Central Asia. **Schultz.**

Uebersicht über die Pamirexpedition 1909 von Arved v. Schultz. Scale 1 : 3,000,000 or 1 inch to 47·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 22. Gotha: Justus Perthes, 1910. *Presented by the Publishers.*

Eastern Asia. **Toepfer.**

Eisenbahnbauten im russisch-japanisch-chinesischen Grenzgebiet Ostasiens. [Von Major Toepfer.] Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 30. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Java. **Topographical Bureau, Batavia.**

Topographische Kaart der Residentie Cheribon. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. 6 sheets. Batavia: Topographical Bureau, 1909.

Gives full information by means of colours and symbols as to character of land, plantations, means of communication and many other subjects, with full explanation of symbols employed. An inset chart shows the triangulation upon which the map is based. Apart from the fact that the mountainous regions are somewhat too dark, this is a good specimen of colour-printing.

AFRICA.

Africa. **Ghisleri.**

Atlante d'Africa. 36 Tavole colorat econ 200 pagine di testo di Notizie Geografiche, Economiche e Statistiche illustrate da 160 cartine di dettaglio e piante topografiche disegnate in base agli ultimi dati degli esploratori dal Prof. Arcangelo Ghisleri. Bergamo: Istituto Italiano d'Arti Grafiche, 1909. *Price* 25*l. Presented by the Publishers.*

In this atlas Prof. A. Ghisleri deals with the geography of Africa in a very complete manner. There is a series of general maps of the different regions and political divisions on the scales of 1 : 4,000,000 and 1 : 8,000,000, with larger scales for special sections, and on the back of each of these is given instructive letterpress to accompany the map, together with plans of towns, ports, railways, rapids and water falls, rainfall, diagrams showing imports and exports, facsimiles of interesting old maps of the same region shown on the general map, and other subjects. Many of the maps are orographically coloured. A special division of the atlas deals with the geology of Ethiopia, and is accompanied by a geologically coloured map on the scale of 1 : 4,000,000. The Italian colony of Eritrea is allotted a section to itself, and is represented by an orographically tinted map on the 1 : 1,000,000 scale, in addition to many plans and diagrams in the accompanying text. The atlas closes with an interesting chapter on the historical geography of Africa, illustrated by facsimile maps and plans from the earliest times.

Egypt. **Survey Department, Cairo.**

Map of Egypt. Scale 1 : 50,000 to 1·3 inch to 1 stat. mile. Sheets: S.E. XXXV.–VIII. El Allaqi; XXXVI.–VII. Seyala; XXXVII.–IV. Aneiba; XXXVII.–VII. Sebua. Cairo: Survey Department, 1909. *Presented by the Director-General, Survey Department, Cairo.*

French Central Africa. **Delingetti.**

Service Géographique de l'Afrique Équatoriale Française. Carte Général de l'Afrique Équatoriale Française publiée par ordre de M. le Gouverneur Général

M. Merlin dressée et dessinée par G. Delingette. Scale 1 : 1,000,000, or 1 inch to 15·8 stat. miles. Sheets 1, 2, and 3. Paris: Augustin Challamel, 1910.

A glance at this map will show what great progress has been made in recent years with the exploration of this part of Africa. The region included in the three sheets extends from Lake Chad and the country to the north as far south as the Ubangi river in lat. 1° N., and, except in the northern sheet, there are few areas that are now altogether untraversed or can be considered as entirely unexplored. The map has been compiled chiefly from the route surveys and compass sketches of French officers. According to the index two other sheets will be published, and the map will then embrace the whole of French Equatorial Africa. The map is clearly drawn and printed in colours.

German South-West Africa. **Gürich.**

Die Marmorvorkommen in Deutsch Südwestafrika und die Marmor-Abbaufelder der Afrika-Kolonial-Marmor-Gesellschaft Hamburg. Auf Grund der Angaben von Prof. Dr. G. Gürich. Scale 1 : 1,000,000, or 1 inch to 15·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 28. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Shows the occurrence of marble in German South-West Africa.

Morocco. **Gentil and Chesneau.**

Atlas Marocain. Par Louis Gentil. Carte dressée et dessinée avec la collaboration de Marius Chesneau. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Paris: Henry Barrère, 1909. *Presented by M. Louis Gentil.*

This sheet extends from Mogador and the Wadi Sus on the west coast to Demrat and Tikirt on the east, and thus includes Marrakesh and the mountainous region to the south. It has been compiled from latest route traverses and sketches, and forms one of a series of similar sheets now in course of publication. Care has been taken in the production and colour printing, and a considerable amount of information is given by symbols regarding villages, wells, means of communication, and other important matters.

Southern Nigeria. **Beverley.**

The Central and Eastern Provinces of Southern Nigeria, 1910. Compiled under the authority of His Excellency Sir Walter Egerton, K.C.M.G., Governor and Commander-in-Chief, by Captain W. H. Beverley, Intelligence Officer, Southern Nigeria. Scale 1 : 500,000, or 1 inch to 7·8 stat. miles. London: Edward Stanford, 1910. *Presented by Captain W. H. Beverley.*

This is by far the best general map of Southern Nigeria that has yet been produced, and until a regular survey has been undertaken it will doubtless be considered the standard map of the country. It covers nearly the same area, and is on the same scale as Captain Woodroffe's map, but is really much more than a new edition of this, since it is an entirely new compilation and drawing, prepared with great care and judgment by Captain W. H. Beverley, Intelligence Officer of Southern Nigeria. The material utilized in the compilation comprise (*a*) triangulation surveys by the recent Boundary Commissions on the frontier of the Cameroons, and by Royal Engineer officers in the Oban hills; (*b*) accurate traverses made in connection with the telegraph construction by Captain Woodroffe, R.E., and by Captain Moir, D.S.O., R.E. The work of the latter officer was particularly valuable, as it runs right across the country from north-west to south-east, and provides means of adjustment for the more approximate route traverses; (*c*) waterway surveys by the Southern Nigeria Marine; (*d*) district and route sketches by military and civil officers. In addition to the above, about forty astronomically determined positions have been utilized, and full advantage has been taken of all previously existing published maps of the country. As regards the more accurate survey work, this naturally presented little difficulty in the preparation of the map, and being first plotted on the projection, the remaining more approximate compass traverse and sketches were adjusted to it, which called for great care and discrimination, as in many cases the lack of agreement between them was considerable. However, Captain Beverley has made the best of these rougher sketches by taking means and checking them one with another at points of crossing and coincidences. Under the title a note gives full information as regards symbols employed, style of writing indicating relative importance of towns, villages, roads, and other kindred subjects. Altogether the map is a most creditable production, and a comparison of it with the edition of Captain Woodroffe's map published five years ago will show what a large amount of exploratory and survey work has recently been carried out in this country.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1:50,000 or 1·3 inch to 1 stat. mile. Sheet XXXI. Ghardimaou. Paris: Service Géographique de l'Armée, 1909. *Price* 1.50 *fr. each sheet.*

AMERICA.

Bolivia. **Hernog.**

Reisewege in Ost-Bolivien (Puerto Suarez bis Santa Cruz—Hügelland von Velasco —Missionen von Guarayos). Von Dr. Th. Herzog. Scale 1:2,000,000 or 1 inch to 31·5 stat. miles. *Petermanns Mitteilungen*, Jahgang 1910, Tafel 25. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Canada. **Dept. of the Interior, Ottawa.**

Standard Topographical map of Canada. Scale 1:250,000 or 1 inch to 3·9 stat. miles. Sheet 10 s.w. Ottawa, Ontario. Ottawa: Department of the Interior, Topographical Surveys Branch, 1910. *Presented by the Department of the Interior, Ottawa.*

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1:190,080 or 1 inch to 3 stat. miles Sheets: 14, Prince Creek, revised to October 13, 1909; 22, Dufferin, revised to November 22, 1909; 68, Swiftcurrent, revised to October 23, 1909; 120, Qu'Appelle, revised to November 3, 1909; Sullivan Lake, revised to November 27, 1909; 264, Brazeau, revised to November 15, 1909; 266, Ribstone Creek, revised to December 1, 1909; 316, Vermilion, revised to October 21, 1909. Ottawa: Department of the Interior, Topographical Surveys Branch, 1909. *Presented by the Department of the Interior, Ottawa.*

AUSTRALASIA.

Western Australia. **Dept. of Lands and Surveys, Perth.**

Plans of Locations of Land open for Selection in the Avon, Nelson, and Plantagenet Districts. *5. sheets. Various scales. Perth: Department of Lands and Surveys, 1909. *Presented by Captain J. Fitzgerald Ruthven.*

GENERAL.

World. **Bartholomew and Lyde**

A School Economic atlas By J. G. Bartholomew, LL.D., with Introduction by L. W Lyde, M.A. Oxford: Clarendon Press, 1910. *Price* 2*s.* 6*d. net. Presented by the Publisher.*

A useful little school atlas, well arranged, and, considering the number and quality of the maps, remarkably cheap. It consists of sixty-four sheets of maps showing physical features, meteorology, population, occupations, races, and religions of mankind, followed by maps illustrative of the natural resources, economics, and commercial products of all parts of the Earth. In addition to the maps there are many diagrams giving graphically, and in figures, statistical information upon subjects such as trade, imports, and exports of various countries. At the commencement of the atlas are about eleven pages of introductory and explanatory letterpress, by Prof. W. L. Lyde.

World. **Johnston**

The Handy Royal Atlas of Modern Geography, exhibiting the present condition of geographical discovery and research in the several countries, empires, and states of the world. By the late Alexander Keith Johnston, LL.D., F.R.G.S., F.R.S.E. With additions and corrections to the present date by G. H. Johnson, F.R.G.S. Edinburgh and London: W. & A. K. Johnston, Ltd., 1910. *Price, bound half morocco,* £1 17*s.* 6*d. Presented by the Publishers.*

The maps in this well-known general atlas have received a considerable amount of revision and correction, but some of them still require further attention. New maps of the South Polar Region, Central Europe, South-East Siberia, Burma, Siam, Southern Rhodesia, Natal and Orange River Colony, Mexico, Chile, and Argentina have been added.

World. **Westwell.**

The Time-indicating Cylinder. Designed by J. W. Westwell. London: The Educational Supply Association, [1910]. *Price* 2*s.* 6*d. net. Presented by J. W. Westwell, Esq.*

One of the many simple educational arrangements recently devised for showing the difference in time between places, and the relation between time and longitude. It consists of a hollow cardboard cylinder, 10 inches high by 4 inches in diameter, round the outside of which is mounted an outline map of the world on Mercator's projection, with the British Empire coloured in red. The top, or lid, of the cylinder is marked off in

twenty-four hours and quarters of an hour, so that, by setting the Greenwich meridian on the map to the Greenwich time shown on this movable top, the time at any place can, of course, be read off approximately. So far, all well and good, but why use a map on Mercator's projection, which, owing to tremendous distortions in high latitudes, is most objectionable for school purposes? The same result as regards relative time and longitude could have been obtained with a hollow globular-shaped map on a flat base, with a movable top or a graduated band or circle made so that it could be revolved round the equator.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during February, 1910. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 3737, Baltic sea: Berghamn to Venö, 3s. 3738, Baltic sea: Berghamn to Abö, 3s. 714, Africa, West Coast: Cape Kantin to Cape Sim. Plans: Safi (Asafi), Mogador (Suira), 3s. 2153, Malacca strait: Port Swettenham (Kwala Klang), 3s.

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, March, and April, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, April, 1910. London: Meteorological Office, 1910. *Price 6d. each. Presented by the Meteorological Office.*

Atlantic, South. **U.S. Hydrographic Office.**

Pilot chart of the South Atlantic Ocean, March, April, and May, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, March, and April, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, April, 1910. London: Meteorological Office, 1910. *Price 6d. each. Presented by the Meteorological Office.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, April, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

South America. **Fisher.**

Eighty-one photographs of South America, taken by F. G. Fisher, Esq. *Presented by F. G. Fisher, Esq.*

The journey upon which these photographs were taken is described by Major Fawcett in the present number of the *Geographical Journal*. Mr. Fisher was his principal assistant upon the recent expedition for surveying the boundary between Bolivia and Brazil. He has evidently made good use of his opportunities for obtaining photographs of the little-known region traversed by the expedition, as well as the more frequented places touched at on the voyage.

(1) Leaving Buenos Aires under escort; (2–4) Tigre, near Buenos Aires; (5) Buenos Aires; (6 and 7) Racecourse, Buenos Aires; (8) Dock, Buenos Aires; (9) Washing-day; (10) Monte Video; (11) Rosario; (12) Asuncion; (13) Railway station, Asuncion; (14 and 15) Loading oranges near Asuncion; (16) The Rio Paraguay; (17) Government troops going to suppress insurrection, Paraguay; (18 and 20) Revolutionary captured boat; (19) Government troops proceeding up river; (21) Revolutionary boat near Puerto Mortinho; (22 and 23) Puerto Mortinho; (24) Passing through the revolutionary boats; (25 and 26) Fort Coimbra; (27) Brazilian Commission leaving Corumba; (28) San Luio de Caceres; (29) Crossing river near Matto Grosso; (30 and 31) Loading canoes, Matto Grosso; (32) Old cathedral, Matto Grosso; (33) Telegraph office, Motto Grosso; (34) Bullock waggon crossing Rio Barbara; (35–37) Crossing Rio Barbara; (38) Party at source of Rio Verde; (39) Women washing, Descalvados; (40 and 41) Camp at Cabeza de Toro; (42) Church, San Matiao; (43) Women washing, Matto Grosso; (44) Down the Guaporé; (45 and 46) Crossing the Rio Guaporé; (47) In the Ricardo Franco plateau; (48 and 49) The

Ricardo Franco ranges; (50) Overlooking Matto Grosso, Ricardo Franco ranges (51 and 52) Guaqui, Lake Titicaca; (53) La Paz; (54 and 55) Inca ruins; (56) Pack mules, high plateau, Mollendo-La Paz railway; (57) Sand hills, Mollendo-La Paz railway; (58 and 59) Lake on high plateau, Mollendo-La Paz railway; (60 and 61) On the high plateau, Mollendo-La Paz railway; (62) Mollendo; (63) New Mollendo; (64) Iquiqui; (65–69) Valparaiso; (70–72) Magellan straits; (73–77) Port Stanley, Falkland islands; (78) Stanley harbour, Falkland islands; (79) Panama (80) Near Panama; (81) Kingston, Jamaica.

West Indies and South America. Bingham

Two hundred and fifty-six photographs taken during a visit to Vieques, Porto Rico, Curaçao, Venezuela, and Colombia in 1906–1907, by Prof. Hiram Bingham, PH.D. *Presented by Prof. Hiram Bingham.*

A series of photographs of considerable geographical value taken during the recent scientific travels of Prof. Bingham of Yale university. They vary in quality as photographic specimens, but the subjects are decidedly typical and well selected.

Island of Vieques: (1–9) Views in the island; (10) The Alcalde of Vieques *Porto Rico:* (11 and 12) Views of San Juan. *Curaçao:* (13–21) Views in the island. *Venezuela:* (22–99, 103–108, 122–124 and 129) Views in and around Caracas: (100–102) Photographs of portraits in the Consejo municipal; (109–114) Tombs and statues in the National Pantheon; (115–121, 127 and 128) Portraits and paintings in the National Capitol; (125) General Ybarra; (126) Son of General Ybarra; (130–139) Views in and around Valencia; (140) On the bank of Rio Guataparo; (141–144) Views near the battlefield of Carabobo; (145–155) Views of the battlefield of Carabobo; (156) Crossing the Rio Chirgua; (157) Distant view of Tinaquillo; (158–160) The Posada at El Salto de Tinaco; (161 and 162) El Salto de Tinaco; (163) A street in Tinaco; (164–168) Views of San Carlos; (169) The Posada at Camoruco; (170) Crossing the river Cojedes; (171) Church of San Rafael; (172) The main street of Agua Blanca; (173) A typical cattle-owner at Agua Blanca; (174) A church in Acarigua; (175) The battlefield of Araure; (176) A bit of the road from Acarigua; (177) The village of Aparicion; (178–181) Views of Guanare; (182) The river Guanare; (183) Ruins of the old church at Tocupido; (184) The Posada on the left bank of the river Bocono; (185) The ferry over the river Bocono; (186) Posada at Sabaneta; (187) The river La Yucca; (188) Ruins of El Marques at Barinas; (189) The plaza of Barinas; (190) Halt by the roadside to Barinas, the river Paguei; (191) A Bongo on the river Paguei; (192) Driving cattle at corral Falso de Paez; (193) Ranchmen at corral Falso; (194) Interior of hut at Acanagua; (195) The owner of the ranch called La Calsada de Paez; (196) Looking south-south-east from La Calsada de Paez; (197–199) Views from the left bank of the river Apure; (200) Group of Venezuelans at Boca Sunipa; (201) Sunrise on the Apure river at La Tigra; (202) Agarrobo landing on the Apure river; (203) Palmarito; (204) A new house near Periquera; (205) The proprietor of the posada of Los Corrales near Periquera; (206) The people of Caña Flores, (207) A typical householder of Caña Flores; (208) The posada at El Amparo; (209) A street corner in El Amparo; (210) The arrival of the cart at El Amparo, completing the journey across Venezuela; (211) The cart mules, at the end of their long walk across Venezuela; (212) A leading physician of Periquera; (213) Regulars on the frontier at El Amparo; (214) General Vallee, the governor of the frontier provinces at Periquera, (215) The alcalde of El Amparo. *Columbia:* (216) On the banks of the Caño Guaratarito; (217) Yaruro Indians near the river Ele: (218 and 219) The deserted Yaruro village near the river Ele; (220 and 228) Our caravan crossing the llanos of Casanare; (221 and 222) The flooded Caño Guato; (223) View from El Limbo, (224) The ranch house at El Limbo; (225) The plaza of San Salvador; (226) Colombians in front of the posada at San Salvador; (227) Resting by roadside; (229 and 231) The llanos of Casanare near Moreno; (230) The plaza of Pore; (232) A group at Nunchia; (233) View from the road from Paya to Pisva; (234) The author and his mule after his journey across Venezuela and Colombia; (235–256) Views in and around Bogota.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

HOTEL METROPOLE,

Northumberland Avenue, Trafalgar Square,

LONDON.



Of world-wide reputation. Conveniently situated, close to Houses of Parliament, Westminster Abbey, Government Offices, Theatres, fashionable quarters, and chief places of interest. Numerous luxuriously furnished suites of apartments. Most magnificent hotel lounge in London.

Telegrams: "Metropole, London."
Telephone: 8120 Gerrard (20 lines).

Gordon Hotels, Ltd.

AROSA.

GRISONS, SWITZERLAND.

6000 feet above Sea-level. Splendid Winter Resort. Recommended by the greatest Medical Authorities.

HOTEL SEEHOF. FIRST-CLASS HOTEL.

Finest situation in Arosa on the Lake. Specially adapted for English visitors during the winter season. Electric light and central heating throughout. New drawing-room and billiard-room with English and French billiards.

CURLING RINK IN FRONT OF THE HOTEL. SKI-ING, SKATING, AND TOBOGGANING.

PENSION, PRICE, 8-14 FRS

For Prospectus and all particulars apply to the proprietor—

Telegraphic Address:—"SEEHOF, AROSA" P. WIELAND.

BÂLE. "HOTEL, VICTORIA."

(Quite near Central Railway Station.)

First-class Family House of old reputation. Lately quite renewed. Fine Large Hall, New Salon, and Conversation Rooms. Restaurant. Electric light and central heating in whole house.

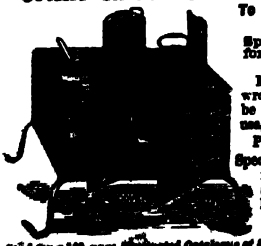
NEW BATHS. LIFT. GOOD CUISINE. MODERATE CHARGES.

Managed by the Proprietor—PAUL OTTO.



THE WROUGHT IRON

CAMP OR TRAVELLING STOVE



To burn wood or any fuel.

Specially designed for Explorers, Missionaries, etc.

Made of malleable wrought iron. Cannot be injured by rough usage. Weight 36 lbs.

Price complete, £3.

Specialities in Oil Cooking Stoves for Home and Export. Any kind of stove made to order.

Send for a 100-page Illustrated Catalogue of Stoves for all purposes, with Prices from the small to the largest.

YOU CAN INSURE YOUR

Art Treasures, Family Heirlooms, &c.

AGAINST FIRE, BUT

Can You Replace Them?

THOUGH

"Dreadnought" Fireproof Doors

cost no more than Wood Doors and are of ordinary appearance, thickness, and weight, they have been able to withstand a temperature of 2000 degrees for 2½ hours. No hinged door of such a size has withstood

HALF AS GREAT AN OFFICIAL FIRE TEST AS THIS.

Supplied to the Government for

The Admiralty, National Gallery, Victoria and Albert Museums Imperial College of Science, Imperial Institute Also Birmingham Telegraph Office; to Edinburgh Law Courts, Royal Insurance Company, Cox's Bank, &c., &c., to Lord Lilford, and many private mansions.

Write for full particulars to

"G.J." DEPT., FIREPROOF DOORS, Ltd.,

46, KING WILLIAM STREET, LONDON, E.C.

BY ROYAL WARRANT TO H.M. THE KING.

POLISHED FLOORS.

RONUK, LTD.

are prepared to Estimate for the Polishing and the maintenance of all kinds of floors in

MANSIONS, HOSPITALS, & INSTITUTIONS

WRITE FOR PAMPHLET

Manufacturers of "RONUK" SANITARY POLISH.

"RONUK," LTD., Head Office & Factory, PORTSLADE, near BRIGHTON.

Depôts—LONDON • 86, York Road, Lambeth, S.E.

... Methods, see pages ii., iv., vi., and viii.

The Geographical Journal.

Authors are alone responsible for their respective statements. In MS. communications all not or unfamiliar geographical names should be written in imitation of Roman type. Al communications for the Editor should be addressed to 1, Savile Row, London, W.

CONTENTS—JUNE.

PAGE

Death of the King. By Major Leonard Darwin, President R.G.S. (with Portrait) . . 621
Glacier Exploration in the Eastern Karakoram. By T. G. Longstaff, M.A., M.D. Oxon (with Diagram, 6 Plates, and Map) 622
The Geographical Factors that control the Development of Australia. By Prof. J. W. Gregory, F.R.S. (with Map) 658
The River Uaupés. By Hamilton Rice, B.A., M.D., F.R.G.S. (with 4 Plates and Map) . . 682
The Cambridgeshire Rivers. By the Ven. W. Cunningham, D.D., Archdeacon of Ely (with 2 Sketch-maps) 700
Canada's Farthest North. By Miss Agnes Deans Cameron (with Illustration) . . . 705
Reviews :—
ASIA—The North-Western Borderlands of India. Western China. AFRICA—South Africa. GENERAL—Bibliography. Educational Books. Military Geography . 708
The Monthly Record 717

EUROPE
The Vegetation of Some Disused Quarries
Local Winds in the South of France
The Expansion of Vienna
Morphology and Glacial Features of the Eastern Carpathians

ASIA
Surveying in the Shan States and Mekong Basin
Explorations in the Tian Shan and in Dzungaria
American Magnetic Research in China
Completion of the French Yunnan Railway

AFRICA
The Atlas of Morocco
The International Frontiers in the Kivu-Ruwenzori Region
The Franco-Liberian Frontier
Trade of Angola

AMERICA
Earthquake in Costa Rica

AUSTRALASIA AND PACIFIC ISLANDS
Dr. Lorentz's Ascent of the Snowy Range in Dutch New Guinea

POLAR REGIONS
Ice in the Arctic Seas during 1909
The "Shelf-ice" of the Antarctic

MATHEMATICAL AND PHYSICAL GEOGRAPHY
Ground-water in Crystalline Rocks
Baer's Law of River Erosion

GENERAL
Honour to Colonel Chaillé-Long

Obituary—Dr. W B Cheadle 727
Correspondence—The True Boundaries of the Continents. By E. Fennell . . . 728
Meetings of the Royal Geographical Society, Session 1909-1910 729
Geographical Literature of the Month 729
New Maps 740

MAPS.

Diagram of Peaks of the Karakoram 625
Map of Changes in the Cambridgeshire Rivers after the Stoppage of the Outfall at Wisbech in 1236 701
Map of Cambridgeshire Rivers in Roman Times 702
Map of Explorations in the Eastern Karakoram 744
Map to illustrate Paper on the Development of Australia 744
Map of the River Uaupés 744

SOLD BY

PARIS: Barrère.
VIENNA: Artaria & Co.
HAMBURG: L. Friederichsen & Co.
ST. PETERSBURG: Watkins & Co.

MANCHESTER: John Heywood.
EDINBURGH: Douglas & Foulis.
DUBLIN: Hodges, Foster & Co.

BERLIN: D. Reimer.
LEIPZIG: F. A. Brockhaus.
NEW YORK: International News Co.

ROYAL GEOGRAPHICAL SOCIETY.

PATRON.

VICE-PATRON.

COUNCIL.

(ELECTED MAY 22, 1916.)

President—Major Leonard Darwin.

Vice-Presidents.

Admiral Sir Lewis Beaumont, K.C.B., K.C.M.G.
Rt. Hon. Lord Curzon of Kedleston, G.C.S.I., G.C.I.E., F.R.S., etc.
Colonel Sir Thomas Hungerford Holdich, K.C.M.G., K.C.I.E., C.B., R.E.
Sir Clements R. Markham, K.C.B., F.R.S., F.S.A.
Rt. Hon. Sir J. West Ridgeway, G.C.B., G.C.M.G., K.C.S.I., LL.D.
H. Yates Thompson, J.P.

Treasurer—Edward L. Somers Cocks.

Trustees—Right Hon. Lord Avebury, D.C.L., LL.D., F.R.S.; Lord Belhaven and Stenton, I

Honorary Secretaries—Colonel Chas. F. Close, C.M.G., R.E.; Colonel Sir D. A. Johns K.C.M.G., C.B., R.E.

Foreign Secretary—Sir John Kirk, G.C.M.G., K.C.B., F.R.S.

Members of Council.

Tempest Anderson, M.D., F.R.S.
Henry Balfour, M.A., F.Z.S.
Captain H. H. P. Deasy.
Colonel H. W. Feilden, C.B.
Admiral A. Moreton Field, F.R.S.
Douglas W. Freshfield.
Prof. Stanley Gardiner, F.R.S
Sir William Edmund Garstin, G.C.M.G.
Sir David Gill, K.C.B., LL.D., F.R.S.
Rt. Hon. Sir George D. Taubman Goldie, K.C.M.G., F.R.S., D.C.L., LL.D.
Colonel R. C. Hellard, C.B., R.E.
Sir Harry H. Johnston, G.C.M.G., K.C.B
Rt. Hon. Lord Lamington, G.C.M.G.
Halford John Mackinder, M.A., M.P.
Alfred P. Maudslay.
Colonel F. R. Maunsell, C.M.G., R.A.
Colonel Sir Colin C. Scott-Moncrieff, K.C.M. K.C.S.I., R.E., LL.D.
Sir Ernest Shackleton, C.V.O.
Mark Aurel Stein, Ph.D., D.Litt.
Sir Edward P. Tennant, Bart.
Sir Frank E. Younghusband, K.C.I.E.

Secretary, and Editor of Publications—J. Scott Keltie, LL.D.

Librarian—Edward Heawood, M.A.

Map Curator.
Edward A. Reeves, F.R.A.S.

Chief Clerk.
S. J. Evis.

Bankers—Messrs. Cocks, Biddulph and Co., 43, Charing Cross.

Candidates for admission into the Society must be proposed and seconded by Fellow and it is necessary that the description and residence of such Candidates should be clearl stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and £3 as annu "subscription for the current year, and thereafter a yearly subscription of £3, due on the 1st Janua "of each year; or he may compound either at entrance by one payment of £45, or at any subsequen "period on the following scale, provided that there shall be at the time no arrears due by him t "the Society:—

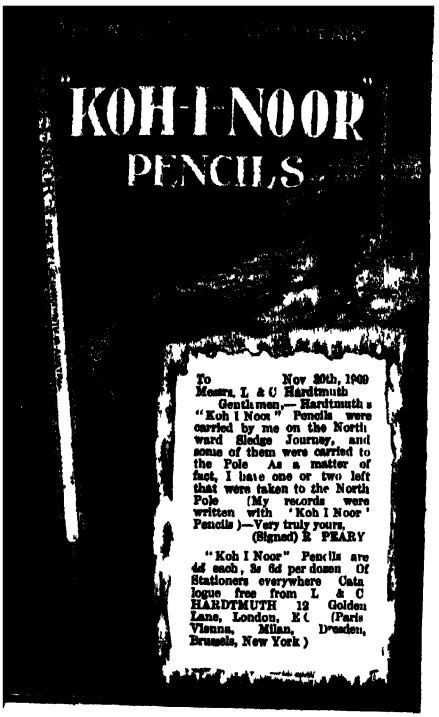
Fellows of 10 years' standing and under	15	...	£30
,, 15 ,, ,, ,,	20	...	£24
,, 20 ,, ,, and over		...	£18 15s.

"No fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrea "Honorary and Honorary Corresponding Members and Fellows elected under Chapter III., Paragrap "5, are not required to make any payments."

All Subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow include admission (with one Friend) to all ordinar Meetings of the Society, and the use of the Library and Map-room. Each Fellow is als entitled to receive a copy of all the Society's Periodical Publications.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had o



THE THAMES
NAUTICAL TRAINING COLLEGE.

H.M.S. "WORCESTER."

Established, 1862. Incorporated, 1893.

Chairman
Sir THOS. SUTHERLAND, G.C.M.G., LL.D.
Vice-Chairman.
Admiral the Hon. Sir EDMUND FREMANTLE, G.C.B., C.M.G.
Capt.-Superintendent:
Commander D. WILSON-BARKER, R.N.R., F.R.S.E., F.R.G.S.
Head Master
F. S. ORME, M.A. (Emm. Coll., Camb.)

The Ship is anchored in the Thames off Greenhithe, in one of the most healthy reaches of the river. The College is devoted more particularly to the education of youths intending to become OFFICERS in the MERCANTILE MARINE, and over 3000 Cadets have already passed out as duly qualified in that capacity. At the same time an excellent system of GENERAL EDUCATION is carried out. Moderate terms.

For illustrated prospectus, apply to the
Secretary, 72, Mark Lane, London, E.C.

CARY PORTER, LTD. Traveller's Surveying Instruments.

7, PALL MALL, LONDON, S.W.

Established 1765.

BY SPECIAL APPOINTMENT TO THE
Admiralty, War Office, India Office, Ordnance Survey, Crown Agents for the Colonies, Royal Naval and Military Colleges, and other Government Departments.
German, Russian, Japanese, and other Foreign Governments.

FACTORY—FINSBURY PARK, N.



Theodolites, Sextants, Artificial Horizons, Telescopes, Barometers, Plane Tables, Binoculars, Compasses, etc.

Only maker of Reeves' Patent Endless Tangents and Artificial Horizons.

GRAND PRIZE AND GOLD MEDAL—FRANCO-BRITISH EXHIBITION, 1908.



DOULTON'S

1909 Patent

TRAVELLER'S PUMP FILTER

ASSURES

Pure Drinking Water

Vide *British Medical Journal* and *Journal of Hygiene.*

OBTAINABLE THROUGH ALL STORES AND OUTFITTING HOUSES.

ROYAL DOULTON POTTERIES,
Lambeth, London, S.E.

DELICIOUS COFFEE.

RED WHITE & BLUE

For Breakfast & after Dinner.

NOTICES.*

Ordinary Meetings during June.—Monday, June 6.—The Yola Cross Riv Boundary Commission, Southern Nigeria. By Major G. F. A. Whetlock, R Journeys in Southern Nigeria. By P. A. Talbot.—**Monday, June 13.**—The La of the Incas. By Sir Clements R. Markham, K.C.B.—**Monday, June 20.** Featur of Alpine Scenery due to Glacial Protection. By Prof. E. J. Garwood.

Research Department, Thursday, June 16.—Report on River Investigatio By Dr. Aubrey Strahan and others. These Meetings are open to all Fellows of th Society.

Conversazione.—The Annual Conversazione will be held at the Natural Histor Museum on **Wednesday, June 22.** Cards will be sent to all Fellows.

Year-book for 1910.—The Year-book for 1910 is nearly ready, and can b obtained on application to the Chief Clerk, 1 Savile Row, W. Price, to Fellow 1*s.*; to non-Fellows, 2*s.* 6*d.*

Fellows' Reading-room.—The front room on the first floor of the Society's hous is arranged as a Reading-room for Fellows. On a few days of the year it will b required for Meetings of the Council, on which occasions a notice will be fixe outside the door of the room.

Any Fellow desiring to have notice of the subjects of papers to be read at th Society's Meetings forwarded to him, can receive such notices by post on paymen in advance to the Chief Clerk, at 1, Savile Row, of 2*s.* per session.

* See also pp. vi., viii., and x.

The clean, wholesome
smell of

WRIGHT'S
COAL TAR SOAP

is, in itself, a
recommendation, and the

freshness felt after using is really Exhilarating.

Good for Prickly Heat and wards off Insect Bites.



"BERKEFELD" FILTER



YIELDS

Absolutely Pure and Germ Free Water.

IN USE ALL OVER THE WORLD.

General Sir James Willcocks, D.S.O., in the *Empire Review*, says:—

"One word more regarding Camp Equipment and I have done. Whatever may or may not be taken, it is absolutely necessary to have a couple of portable filters, and the 'Berkefeld' is the best."

THE BERKEFELD FILTER CO., LTD.,

121, OXFORD STREET, LONDON, W.

Experience has taught that no expedition may be considered to be completely and thoroughly equipped without a plentiful supply of

BOVRIL

KEEPS GOOD FOR ANY LENGTH OF TIME.

Telegraphic Address—"ZEITGEIST, LONDON." Telephone—4284 GERRARD.

EDWARD STANFORD,

Geographer to His Majesty the King.

Government Map Depôt: 12, 13, and 14, LONG ACRE, LONDON, W.C.

DEPARTMENTS.

PUBLISHING.—Maps and books arranged for and published. Estimates and terms on application.

MAP SELLING.—This department includes the productions of every map publisher of repute both at home and abroad, including the ORDNANCE and GEOLOGICAL Survey Maps, and the ADMIRALTY CHARTS, with the Pilots and Sailing Instructions which accompany them.

MAP MOUNTING OF ALL KINDS done on the premises by skilled workmen.

MAP ENGRAVING.—This department includes Drawing, Lithography, and Engraving of all kinds. Edward Stanford's large collection of copyright Maps is available for transfers for book illustration, etc. Estimates given.

BOOK SELLING.—The best Guide Books, Works of Travel, and all standard Geographical Works are kept in stock. Books of any sort supplied.



PORTABLE

ACETYLENE LIGHTS.

Easy to carry. Easy to handle. Easy to understand.

No attention required after lighting.

FOR TRAVELLERS. PROSPECTORS. PIONEERS.

For all Countries and all Climates.

FLARE-LIGHTS each 500 to 5000 c.p. **HAND-FLARES** 250 to 1000 c.p.

Not affected by Weather. Will stand a Gale.

HAND-LAMPS 100 c.p. **HAND-LANTERNS** 20 c.p.

PORTABLE GENERATORS complete in one casing for 2 to 20 lights.

Full particulars from the Patentees and Sole Makers

NOTICE.

PHOTOGRAPHS.

ROYAL GEOGRAPHICAL SOCIETY.

It would greatly add to the value of the Collection of Photographs whic has been established in the Map Room of the Royal Geographical Society, I all the Fellows who have taken photographs during their travels, woul forward copies of them to the Map Curator, by whom they would be acknow ledged. Should the donor have purchased the photographs, it will be usefu for reference if the name of the photographer and his address are given.

POTTER'S

Catalogue (84 pp.) of

Books on Travel and Sport

(chiefly new copies at greatly reduced prices)

SENT POST-FREE.

WILLIAM POTTER,

30, Exchange Street East, Liverpool.

BOUGHT. SOLD

CAMERAS

EXCHANGED

ILLUSTRATED AND BARGAIN LISTS POST FREE

Our Illustrated List.

248 pages. 500 Illustrations.

EVERYTHING PHOTOGRAPHIC.

THE WESTMINSTER PHOTOGRAPHIC EXCHANGE LTD

111, OXFORD STREET, 115, VICTORIA STREET, LONDON



SKINNER & GRANT,

TAILORS,

59, REGENT STREET, LONDON, W.

(7 Doors from Piccadilly Circus).

BEST GOODS AT MODERATE PRICES.

Frock Coat and Vest	from	£4 4 0
Morning Coat and Vest	,,	3 10 0
Lounge Suits	,,	3 10 0
Trousers	,,	1 1 0
Overcoats	,,	3 3 0
Dress Suits	,,	5 5 0

MOTOR COATS A SPECIAL FEATURE. A TRIAL ORDER SOLICITED.

BROWN & ROWLEY

WATLING STREET, CITY,

Printers,

Account Book

Manufacturers,

AND

General Stationers.

NATURAL HISTORY

WATKINS & DONCASTER

NATURALISTS

36, STRAND, LONDON, W.C.

(Five Doors from Charing Cross)

keep in stock every description of Apparatus, Cabinets, Books, and Specimens for Collectors of

BIRDS' EGGS, BUTTERFLIES AND MOTHS, &c.

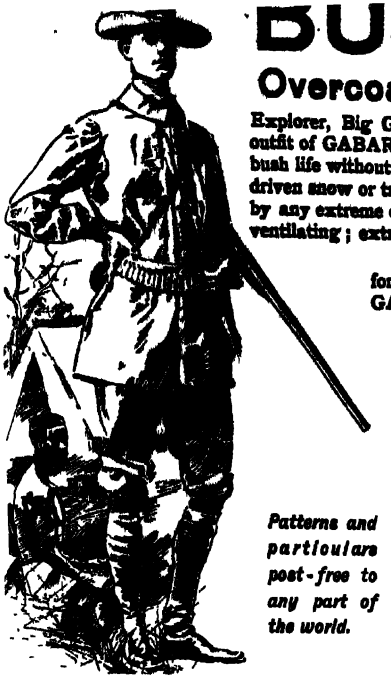
Illustrated

BURBERRY

Overcoats, Suits and Tents.

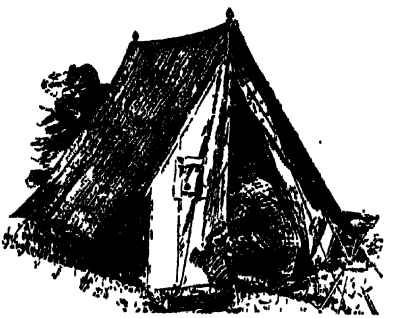
Explorer, Big Game Hunter, Mountaineer or Colonist with an outfit of GABARDINE has that which will stand the rigours of bush life without showing signs of wear, and keep out blizzard-driven snow or tropical downpours. The proofing is not affected by any extreme of climate; it is wind-proof yet faultlessly self-ventilating; extremely light, yet so strong as to be untearable.

Such union in numbers of the great essentials for comfort in camp life is to be found in GABARDINE AND GABARDINE ONLY.



GABARDINE SUIT.

Patterns and particulars post-free to any part of the world.



GABARDINE TENTS.
Extremely light, imperishable, and non-absorbent.

BURBERRYS, 30 to 33, Haymarket, LONDON.

NORWAY

and back,

13 DAYS
FOR
12 GUINEAS
AND
UPWARDS.

Visiting Finest Fjords,

By the Famous Yachting Steamer "OPHIR," and s.s. "OMRAH," 8,130 Tons,

From LONDON 24th JUNE and 15th JULY.
From GRIMSBY 16th and 30th JULY, 13th and 27th AUGUST.

LUXURIOUS ACCOMMODATION.

Write for free Illustrated booklet to ORIENT S.N. CO., 5, Fenchurch Avenue, London, E.C., and 28, Cockspur Street, S.W.
Managers: F. GREEN & CO., and ANDERSON, ANDERSON & CO.

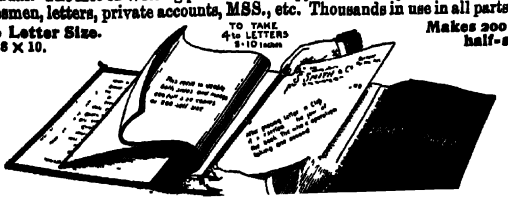
The Zanetic Pat. Copying Book

To copy letters while writing, you simply place your writing paper in the Zanetic copying book and write as usual. The Act of Writing produces the copy. Extremely useful for keeping copies of orders to tradesmen, letters, private accounts, MSS., etc. Thousands in use in all parts of the world.

Order as No. 20/100 Letter Size.
To take letters 8 × 10.

4/9 complete.
Weight 1lb. 14oz.
Refills 1/6 each.
Weight 12oz.

The simplest, yet the most efficient and economical of all copying systems.



Makes 200 full size or 400 half-size copies.

If 200 leaves 5/6, refills 2/3 each. Note size: 100 leaves 3/6, refills 1/3 each; or if 200 leaves 3/6, refills 1/6 each.

Samples of Zanetic copying paper free

INSTRUCTION FOR INTENDING TRAVELLERS.

Under the authority of the Council of the R.G.S.

Arrangements have been made for the instruction of intending travellers in the following subjects:—

Surveying and Mapping, including the fixing of positions by Astronomical Observations. By Mr. E. A. Reeves, F.R.A.S., Map Curator of the Society.

Geology, including practical training in the field. Under the superintendence of the Director General of the Geological Survey.

Botany. Under the superintendence of the Director, Royal Gardens, Kew.

Zoology.

Anthropological Measurements. Under the superintendence of Dr. J. G. Garson, Anthropological Institute.

Photography. By Mr. John Thomson, Author of 'Photographic Illustrations of China and its People,' and other works.

Meteorology. By Dr. H. R. Mill.

Outfit and Health. Dr. Charles F. Harford, Secretary of the Travellers' Health Bureau.

The Lessons are given on days and at hours arranged between the Instructor and the pupil. Tickets for the lessons, at 2s. 6d. for each hour's lesson, must be previously procured at the Offices of the Society

Silvertown

India Rubber, Ebonite, & Gutta Percha Goods
of all Descriptions.
WATERPROOF GARMENTS and FABRICS.

The India Rubber, Gutta Percha & Telegraph Works Co.,
Limited.

Head Offices - - 106, CANNON STREET, LONDON, E.C.
Works - - - - SILVERTOWN, LONDON, E.

BRANCHES:
HOME: Belfast, Birmingham, Bradford, Bristol, Cardiff, Dublin, Glasgow, Liverpool, Manchester, Newcastle, Portsmouth, Sheffield.
ABROAD: Adelaide, Brisbane, Buenos Ayres, Bulawayo, Calcutta, Christchurch (N.Z.), Durban, Johannesburg, Melbourne, Perth (W.A.), Sydney.

CLARKSON'S
SECOND-HAND OPTICAL MART,
338, HIGH HOLBORN, W.C.
(*Opposite Gray's Inn Road*).

Sextants, Theodolites, Surveyors' Instruments, Prism Binoculars, Telescopes, and other Second-hand Optical Instruments by the best makers.
Telephone: 2149, Holborn.

All communications respecting Advertisements in the
"GEOGRAPHICAL JOURNAL"
to be sent to
G. STREET & CO., LTD.,

Telephone No. 5197 Gerrard
MARTIN, HOOD & LARKIN,
MAP SPECIALISTS,
Lithographers and General Printers,
8, Gt. NEWPORT ST., LONDON, W.C.

ALL KINDS OF
Maps, Plans, and Charts.

SUMMER IN THE ALPS.

Rooms may be selected from hotel plan, and reserved in advance by THOS. COOK & SON for any of the following Mountain Resorts:—

ADELBODEN	DIABLERETS	SAMADEN
ADDERMATT	ENGELBERG	ST. MORITZ
AXENSTEIN	GRINDELWALD	SEELISBERG
BRUNIG	LES AVANTS	SONNENBERG
BURGENSTOCK	MT. PELERIN	ZERMATT
CHAMPERY	PONTRESINA	RIFFELALP

Weekly departures at reduced railway fares. Write for programme, "Summer in the Alps."

THOS. COOK & SON,

CHIEF OFFICE:

LUDGATE CIRCUS, LONDON.

BRANCHES THROUGHOUT THE WORLD.

PROVISIONS AND OUTFIT.

GRIFFITHS, McALISTER & Co.,

EXPORT PROVISION MERCHANTS, ETC.,

29–31, Manesty's Lane, Liverpool. 14, Billiter St., London, E.C

Suppliers of all kinds of Provisions, Camp Equipment, Medical Stores, Wines, Spirits, and Mineral Waters, &c, for Exploring and Mining Expeditions; also for private use abroad.

All Goods suitably packed for Hot and Cold Climates, and made up in loads suitable for all modes of Transport.

Suppliers to Lieut. Shackleton's Antarctic Expedition, 1907–1909.

CONTRACTORS TO THE CROWN AGENTS FOR THE COLONIES.

Telegraphic Addresses: "COOMASSIE," LIVERPOOL. "APPEASABLE," LONDON

Codes used: A, B, C, 4th and 5th Editions and Lieber's.

ESTABLISHED 1880.

CHARING CROSS TURKISH BATHS

Northumberland Avenue.

NEVILL'S.

SEPARATE BATH FOR LADIES OPEN ALL DAY.

Also at LONDON BRIDGE, BROAD STREET, CITY, Etc., Etc.

ROYAL GEOGRAPHICAL SOCIETY.

THE SOCIETY'S PUBLICATIONS.

THE GEOGRAPHICAL JOURNAL. Issued Monthly. Delivered free to all Fellows; price to No Fellows, 2s.

GENERAL INDEX TO THE FIRST 20 VOLUMES OF THE GEOGRAPHICAL JOURNA 1893–1902. 660 pages, double columns. Price, to Fellows, 6s. 6d. net; to Non-Fellows, 10s. 6d.

JOURNAL OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1830–1880. volumes, 8vo. Price, to Non-Fellows, £1 per vol. net; to Fellows, 15s. per vol.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1855-18 23 volumes, 8vo. In parts, to Non-Fellows, 1s.; to Fellows, 9d. per part.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (NEW SERIES), consists 14 volumes, extending from 1879 to 1892.

Each volume covers on an average 840 pages, the selling price being 18s. per volume. These volumes constitute a rec of exploration and geographical work in all parts of the world. In the 14 volumes there are some 350 maps, besi numerous illustrations of characteristic scenery in the least-known parts of the world. It is believed that a compl set of the *Proceedings* would be a valuable addition to public libraries and other institutions, while many priv individuals might wish to have the volumes. The series is now offered, bound in cloth, at £6 per set.

SUPPLEMENTARY PAPERS.

Containing a large number of Memoirs and Narratives of considerable length, besides several valuable Bibliographi over 30 Maps and numerous Illustrations. Sold for half price, £2 for the four volumes.

HINTS TO TRAVELLERS.—The ninth revised edition, edited, under a Committee of the Coun by E. Reeves, F.R.A.S., Map Curator and Instructor to the Society. Price 15s. net; to Fellows, at the House of Society, 10s.

TRIGONOMETRY—PLANE AND SPHERICAL. Specially arranged for the use of Students atten ing the Royal Geographical Society's course of Instruction. By E. A. Reeves, F.R.A.S. Price 5s. net.

HINTS ON OUTFIT FOR TRAVELLERS IN TROPICAL COUNTRIES. By Charles Forb Hanford, M.A., M.D. Price 1s. 3d. net.

CATALOGUE OF THE LIBRARY OF THE R.G.S. Edited by Dr. H. R. Mill. Price, Fellows, 2s. 6d. net; to Non-Fellows, 5s.

THE YEAR-BOOK OF THE SOCIETY. Issued annually. Price, to Non-Fellows, 2s. 6d.; Fellows,

SYLLABUSES OF INSTRUCTION IN GEOGRAPHY. I. In Elementary Schools. II. In Seconda Schools. Single copies gratis on application at 1, Savile Row, W.

EXTRA PUBLICATIONS.

THE FIFTY YEARS' WORK OF THE ROYAL GEOGRAPHICAL SOCIETY. By Clements R. Markham, K.C.B., F.R.S., President. 235 pp. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d net.

THE LANDS OF CAZEMBE. LACERDA'S JOURNEY TO CAZEMBE IN 1798. Translat and annotated by Captain R. F. Burton. 271 pp., with Map. Also Journey of the Pombeiros, P. J. Baptista, a Amaro José, across Africa from Angola to Tette on the Zambese. Translated by B. A. Beadle. And a *Résumé* of t Journey of MM Monteiro and Gamitio. By Dr. C. T. Beke. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net

THE TOPOGRAPHY OF THE BATTLE OF PLATÆA. By G. B. Grundy, B.A. Price, boun in half-calf, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

NOTES ON THE KURIL ISLANDS. By Captain H. J. Snow. 8vo, 88 pp., with two large Char revised by Captain Snow. Price, in boards, to Non-Fellows, 4s. net; to Fellows, 2s. net.

EASTERN PERSIAN IRAK. By General A. Houtum-Schindler. 8vo, 132 pp., with Map. Pri to Non-Fellows, 5s. net; to Fellows, 3s. net.

A JOURNEY ON THE UPPER MEKONG, SIAM. By H. Warington Smyth. Sixty Illustratio and three Maps. Price, to Non-Fellows, 7s 6d. net; to Fellows, 4s. net.

BIBLIOGRAPHY OF ALGERIA, FROM THE EXPEDITION OF CHARLES V. IN 1541 T 1887. By Sir R. L. Playfair. Price, to Non-Fellows, 7s. 6d.; Fellows, 5s. net.

EDUCATIONAL REPORTS. By Dr. J. Scott Keltie. Price, to Non-Fellows, 5s.; to Fellows, 2s

SUPPLEMENT TO THE BIBLIOGRAPHY OF ALGERIA, FROM THE EARLIEST TIM TO 1895. By Sir Lambert Playfair, K.C.M.G. Price, to Non-Fellows, 5s. net; to Fellows, 2s 6d. net.

MAP OF THE KARAKORAM HIMALAYAS. In two sheets, with text. By Sir W. Mart Conway, M.A. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

SURVEYING AND EXPLORING IN SIAM. By James McCarthy. Large Maps of Siam many Illustrations. 236 pp. 8vo. Price, to Non-Fellows, 10s. 6d. net; to Fellows, 6s. 6d. net.

THE DISTRIBUTION OF RAINFALL OVER THE LAND. By Dr. A. J. Herbertson. Pri to Non Fellows, 5s. net; to Fellows, 2s. 6d. net.

ON THE RESULTS OF A DEEP-SEA SOUNDING EXPEDITION IN THE NORT ATLANTIC DURING THE SUMMER OF 1899. By R. S. Peake, M.Inst.C.E. With Notes on Temperature, De Sea Deposits, &c. By Sir John Murray, K.C.B., F.R.S. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net

ARCTIC PAPERS FOR THE EXPEDITION OF 1875. A selection of Papers on Arctic Ge graphy and Ethnology. Reprinted and presented to the Arctic Expedition of 1875, by the President, Council, a Fellows of the Royal Geographical Society. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 5s. net.

THE ANTARCTIC MANUAL, FOR THE USE OF THE EXPEDITION OF 1901. Edit by George Murray, F.R.S. 602 pp. royal 8vo. Price, to Non-Fellows, 15s. net; to Fellows, 10s. net.

JOURNEY TO LHASA AND CENTRAL TIBET. By Sarat Chandra Das, C.I.E. Edited the Hon. W. W. Rockhill. Maps and Illustrations. 285 pp. 8vo. Price, bound in cloth, to Non-Fellows, 10s. 6 net; to Fellows, 7s. net.

NEW MAP OF THE RIVER CONGO, in Ten Sections on Five Sheets. Scale 1 : 500,000 miles = 1 inch). By the Rev. George Grenfell. In small portfolio, with Memorandum. Price, to Non-Fellow 12s. net; to Fellows, 6s. net.

ON RECENT CONTRIBUTIONS TO OUR KNOWLEDGE OF THE FLOOR OF THE NORT ATLANTIC OCEAN. By Sir John Murray, K.C.B., F.R.S., and R. E. Peake, M.Inst.C.E. Price, to Non-Fellows, net; to Fellows, 2s. 6d. net.

AN EXPEDITION INTO THE CENTRAL TIAN-SHAN MOUNTAINS. By Dr. Gottfri Merzbacher. Price, to Non-Fellows, 12s. net; to Fellows, 9s. net.

MAP OF TIBET. New edition, 1906. Price, to Fellows, 3s. net; to Non-Fellows, 5s. net.

GEOGRAPHICAL DISTRIBUTION OF VEGETATION IN SOMERSET. By Dr. C. E. Mos Price, to Fellows, 2s 6d. net; to Non-Fellows, 5s. net.

BIBLIOGRAPHY OF TOPOGRAPHICAL AND GEOLOGICAL WORKS ON THE PHLEGRÆA FIELDS. By R. T. Günther. Price, to Fellows, paper covers, 2s. 6d., boards, 3s. net; to Non-Fellows, paper cover 5s., stiff boards, 6s. net.

NATIONAL ANTARCTIC EXPEDITION, 1901–4. Charts of the Expedition, with Memoir by Lieu G. F. A. Mulock, R.N. Price, to Non-Fellows, 12s. 6d. net; to Fellows, 9s. net.

MOUNTAIN PANORAMAS FROM THE PAMIRS AND KWEN LUN. With Introduction a Descriptions by Dr. M. Aurel Stein. Price, to Non-Fellows, £1 net; to Fellows, 14s. net.

BATHYMETRICAL SURVEY OF THE FRESHWATER LOCHS OF SCOTLAND. Und Illustrations. Pri

MACMILLAN'S NEW BOOKS.

In Lotus-Land Japan.

By HERBERT G. PONTING, F.R.G.S. With 8 Illustrations in Colour and 96 in Monochrome, from Photographs by the Author. Crown 4to. 21s. net.

The Statesman's Year-Book.

Statistical and Historical Annual of the States of the World, for the Year 1910. Edited by J. SCOTT KELTIE, LL.D., Secretary to the Royal Geographical Society. Crown 8vo, 10s. 6d. net. [*Immediately.*

"We have no hesitation in describing 'The Statesman's Year-Book' as the best encyclopædia of the world in one volume."—*The Standard.*

MACMILLAN & CO., LTD., LONDON.

J. & J. LEIGHTON, BOOKSELLERS AND BOOKBINDERS,

ESTABLISHED 1798.

40, BREWER STREET,
Golden Square, Regent Street, London, W.

Illuminated MSS., Incunabula and other Early Books with Woodcuts, Bookbindings of Historical and Artistic Interest, etc., etc.

ILLUSTRATED CATALOGUE, 7,500 items, with upwards of 2,060 facsimile reproductions in line and half-tone, with full descriptions and bibliographical information.

SPECIMEN PART WITH PROSPECTUS, POST FREE ON APPLICATION.

ROYAL GEOGRAPHICAL SOCIETY.

NEW EXTRA PUBLICATIONS.

"Researches on Ptolemy's Geography of Eastern Asia (Further India and Indo-Malay Archipelago)."

By Colonel G. E. GERINI, M.R.A.S.

Published in conjunction with the Royal Asiatic Society. 970 pages, with maps. Price 15s. net; to Fellows, 12s.

This is the result of many years' investigation in Further India and the Indo-Malay Archipelago, by Colonel Gerini, and is one of the most important contributions that have been made to the literature of Ptolemy's Geography.

New Map of Eastern Turkey-in-Asia, Syria, and Western Persia.

On the scale of 1 : 2,000,000, or 32 miles to an inch, with accompanying text, in case, with pocket for map. Price to Fellows, unmounted, 5s. net, mounted in cloth, 6s. 6d. net; to Non-Fellows, unmounted, 8s. 6d. net, mounted, 10s.

This map is based on the most trustworthy recent surveys and explorations by travellers of all nationalities, and may be regarded as the most complete map of the region available.

Copies may be obtained at the Royal Geographical Society

AERTEX CELLULAR

This Label on All Garments.

THE CELLULAR CLOTHING CO. LTD. AERTEX LONDON

The Use of Red Garments in the Tropics.

IT has been definitely proved by the medical profession that the sun's rays in the Tropics act very forcibly, but that it is the blue rays (known scientifically as the actinic) which produce sunstroke, and that the red rays (known as the non-actinic rays) do not have any harmful effect. Heat alone is not injurious, as is evidenced by the fact that persons can stand high temperatures in Turkish baths, and stokers stay for days in boiler-rooms, without any ill effect, but heat together with strong sunshine often result in disaster. We have therefore produced a specially dyed AERTEX fabric which is not a bluish-red, but is so carefully selected as to colour, that only the red and orange rays are allowed to act on the body. The great comfort derived from the wearing of AERTEX Garments in hot countries will, we believe, be still further increased by the substitution of AERTEX Garments made from red yarns which have been chemically tested and proved to be able to withstand the actinic rays. We are therefore confident these garments will meet a great need, and are admirably adapted for tropical use.

Suggestions from Medical men for fabric or garments specially suited for local requirements are respectfully invited.

NON-ACTINIC AERTEX CELLULAR.

Neck Sizes 14 to 17.

Day Shirt (soft throughout) **6/6**

Tennis Shirt, with Collar and Pocket .. **7/-**

Tunic Shirt, Soft Front, Laundered Linen Cuffs and Neckband

Day Shirt, with Small Linen Front and Round Linen Cuffs

WHOLESALE ONLY

THE CELLULAR CLOTHING CO., Ltd.,

72 and 73, FORE STREET,

LONDON, E.C.

Cable Address: "CELLULAR," LONDON. A.B.C. Code used.

Telephone: 838, London Wall.

AERTEX Cellular is entirely of British Manufacture.

LONDON RETAIL AGENTS—

City: ROBERT SCOTT, Ltd., 8, Poultry, Cheapside,

West End: OLIVER BROTHERS, Ltd., 417, Oxford S

Full Price List of Aertex Cellular Goods for Men Women Children sent post free on application

Any Garments mentioned in price list may be obtained from the above-named Agents, who keep a complete stock of AERTEX Cellular Garments and Fabrics.

All materials may be obtained at the above addresses by the yard, any length cut. Very light fabrics specially manufactured for the tropics.

Special study is given to Outfits for India and the Colonies. Estimates for complete outfits furnished at short notice.

USED BY DOCTORS and the PUBLIC for OVER HALF-A-CENTURY.

Dr. J. Collis Browne's Chlorodyne

The ORIGINAL and

The Best Remedy Known for

COUGHS, COLDS, ASTHMA, and BRONCHITIS.

Acts like a Charm in

DIARRHŒA, CHOLERA, and DYSENTERY.



ONLY GENUINE.

Admitted by the Profession to be the

MOST VALUABLE REMEDY

ever discovered.

Effectually cuts short all attacks of **SPASMS.**

The only Palliative in

NEURALGIA, TOOTHACHE, GOUT, RHEUMATISM.

Convincing Medical Testimony accompanies each bottle.

SOLD IN BOTTLES BY ALL CHEMISTS.

at 1/1½, 2/9, and 4/6 each.

INDEX TO ADVERTISEMENTS.

Where no number is given, the Advertisement does not appear this month.

PAGE

Account Book Makers.
Brown & Rowley 6

Bookbinders, Booksellers, &c.
Leighton, J. & J. 11
Potter, Wm. 6
Sotheran & Co. ..... *Cover* 2

Boots and Shoes.
Dowie & Marshall 13
Goodyear-Welted.....

College.
Thames Nautical Training 3

Cutlery.
Hill & Son.....

Electrical Engineers.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd. ... 8

Electric Lighting.
Wakefield & Co. 5

Filters.
Berkefeld 5
Doulton & Co., Ltd. 3

Foods for Travellers.
Bovril 5
Oxo 14
Red, White & Blue Coffee 3

Fountain Pens.
Waterman's Ideal Fountain Pen

Furniture and Floor Polish.
Ronuk, Limited 16

Hotels and Restaurants.
Hôtel Métropole 15
Hotel Seehof, Arosa.....
Hotel Victoria, Bale..... 15

Instruments for Travellers.
Cary, Porter, Ltd. 3
Clarkson & Co. 3

Insurance.
Eagle Insurance Co.....
London and Lancashire.....
Scottish Provident Institution ...
Scottish Widows' Fund .....

PAGE

Medicines & Medicine Cases.
Browne, Dr. Collis 12
Burroughs Wellcome & Co. .....
Dinneford & Co. ..... *Cover* 2
Evans, Lescher & Webb, Ltd. ...
Muscatol .....
Parke, Davis & Co. 15

Naturalists.
Watkins & Doncaster 6

Outfitters.
Cellular Clothing Co. 12
Dowie & Marshall 13
Griffiths, McAllister & Co. 9
Silver, S. W. & Co. and Benjamin Edgington .....*Cover* 4
Tucker, Joseph 13

Pencils.
Koh-i-noor..... 3

Photo Engravers.
Bale, Sons, & Danielsson, Ltd. *Cover* 2

Photographic.
Burroughs Wellcome & Co. .....
Newman & Guardia .....
Westminster Photo Exchange .. 6

Portable Buildings.
Harbrow, W. .....

Publishers.
Heinemann, Wm. .....
Macmillan & Co., Ltd. 11
Murray .....
Philip, G., & Son, Ltd. .....
Potter, Wm. 6
Stanford, Edward 5
Witherby & Co. .....

Railways.
Great Central Railway .....
Great Eastern Railway .....

Razors.
Kropp Razor .....*Cover* 2

PAGE

Soaps.
Wright's Coal Tar 4

Sporting Outfits.
Burberrys 1

Stores for Expeditions, &c.
Griffiths, McAllister & Co. 9
Silver, S. W., & Co., and Benjamin Edgington ..... *Cover* 4
Spratt's Patent, Ltd. .....
Tucker, Joseph 13
Wilkinson Sword Co.....

Stoves.
Poore, Wm., & Co. 15

Tailors.
Skinner & Grant 6

Tents.
Burberrys 7
Silver, S. W., & Co., and Benjamin Edgington .....*Cover* 4
Tucker, Joseph 13

Tobacco.
Player & Sons .....

Tours and Excursions.
Cook, T., & Son 9
Orient Line 7

Turkish Baths.
Nevill's, Charing Cross 9

Typewriters.
Blick .....
Oliver Typewriter Co., Ltd..... 16
Remington Typewriter Co. .....

Wines and Spirits.
Deutz & Geldermann ..... *Cover* 4
Heidsieck, Charles ..... *Cover* 4
Martell & Co. .....

BOOTS FOR EXPLORERS.



REGISTERED AT STATIONERS' HALL.)

DOWIE & MARSHALL

(Established 1894)

Have for many years made a special study of the various kinds of boots required for different climates, and they have had the gratification of pleasing many Travellers, including members of the R.G.S., from the time of Dr. John Rae of Arctic renown to Sir H. M. Stanley, the African Explorer.

Country Customers should send, as guide to measurement, a pair of old boots and outlines of the feet.

Only the best hand-sewn Boots are made.

455, WEST STRAND, LONDON.

G.P.O. Telephone No. 9015 Central. **(3 doors from Trafalgar Square.)**

IF YOU ARE GOING ABROAD

CALL UPON

JOSEPH TUCKER

AND INSPECT

his large and varied stock of TROPICAL CLOTHING, CAMP FURNITURE and EQUIPMENT, STORES, and every requisite for travel and residence abroad.

79, Newington Green Road, LONDON, N.

SHIPPING AND PASSENGER AGENT,

Contractor to H.M. and the Dutch Governments.

Telegrams: "Turbula, London."

Telephone:

By Royal Warrant  to H.M. THE KING.

When appetite is dull and you feel the need of something to make your meals enjoyable, just try the effect of a little

LEA & PERRINS' SAUCE.

It is a wonderful appetizer, and assists digestion.

Excellent with MEAT DISHES, FISH, SOUP, GAME, CHEESE, SALADS, &c.

OXO

for explorers

The great value of OXO to explorers lies in the fact that it contains the nourishment of beef in compact form. It is easily prepared and is ready in a moment. As a nourishing food in case of illness, it is unsurpassed. OXO is a scientific blend of beef extract which stimulates, and beef fibrin which nourishes.

And OXO is guaranteed pure—it is made by the OXO Company throughout from ranch to bottle. *OXO differs from other fluid beefs in that all raw material used comes from OXO's own cattle.* Not one single ounce of raw material is bought from an outside source. This is important, because the OXO Company thus have complete control over its manufacture, and are able to guarantee absolute purity and healthiness.

OXO, 4, Lloyd's Avenue, London, E.C.



Lafayette, photo.]

HIS MAJESTY KING EDWARD VII.,

PATRON OF THE ROYAL GEOGRAPHICAL SOCIETY.

The

Geographical Journal.

No. 6. JUNE, 1910. Vol. XXXV.

Death of the King.

The Council and Fellows of the Royal Geographical Society have especial reasons for sharing in the universal sorrow felt at the death of His Most Gracious Majesty, King Edward VII., Emperor of India. The King did the Society the great honour of becoming its Patron when he ascended the Throne in 1901, and of continuing the Royal Bounty of his predecessor, a grant which enables the Society to award each year the two Royal Medals. Both as Prince of Wales and as King, his late Majesty took a personal interest in the affairs of the Society, the meetings of which he attended on many occasions before he ascended the Throne, and on one memorable occasion after he became King, namely at the meeting at the Queen's Hall to welcome the Duke of the Abruzzi. His genuine interest in geography and in geographical discovery was further shown by the sympathetic encouragement he gave to many distinguished travellers at personal interviews graciously accorded to them at Marlborough House or Buckingham Palace.

On the great qualities which made him in many respects one of the most influential and beneficent of Monarchs it is not necessary here to dilate. His death is universally felt to be a loss, not only to the British Empire, but to the world at large.

His successor, King George V., who as Prince of Wales has been for many years Vice-Patron of the Society, has always taken an active interest in its affairs. The Council trust that His Majesty will be graciously pleased to succeed his late Father as Patron of the Society.

LEONARD DARWIN,

President R.G.S.

GLACIER EXPLORATION IN THE EASTERN KARAKORAM.*

By T. G. LONGSTAFF, M.A., M.D. Oxon.

Of the mountain regions of High Asia which are politically accessible to the ordinary traveller, there is none concerning which detailed information is more scanty than the eastern section of the great Karakoram range. Between Younghusband's Muztagh pass and the Karakoram pass on the Leh-Yarkand trade-route, a distance of 100 miles as the crow flies, we have no record of any passage across the main axis of elevation having ever been effected by a European. There are, however, traditions relating to an old route known as the Saltoro pass, and it was the elucidation of this latter problem at which I aimed last year.

Concerning the country east of K_2, Burrard wrote in 1907: "There is no more likely spot than this for great undiscovered peaks to be existing" (Burrard and Hayden's 'Sketch of the Geography and Geology of the Himalaya Mountains and Tibet,' p. 100). So confident was I of the accuracy of this forecast by one of our greatest authorities on Himalayan problems, that I provided myself with an instrument for the special purpose of measuring these peaks, choosing on Mr. Reeves' recommendation the Indian Survey clinometer.

East of 77° E. and north of 35° 30′ N. lies an area roughly measuring a degree in each direction into which no traveller has ever penetrated, and which has never been surveyed. We know that it is a region of snow-clad mountains, and that it is quite uninhabited. The known area may be regarded as limited on the south by the conscientious labours of the G.T.S. of India (*vide* quarter-sheets 44*a* south-west and south-east, which shows the head of the Nubra valley bounded by the main water-parting in the latitude of the Karakoram pass); on the east by the headwaters of the Yarkand river, explored by the intrepid Hayward under such exceptionally difficult circumstances in 1868 (*J.R.G.S.*, 1870, vol. 40, p. 52). On the north by Raskam, the scene of so many bloody raids by the Kanjutis; and on the west by Younghusband's discoveries around the glacier sources of the Oprang river in 1889 ('The Heart of a Continent,' chap. x.), of which more anon.

Two other travellers have knocked at these closed doors. In the year 1835 Vigne attempted to find the Saltoro pass, of the existence of which he had heard from the natives. He reached a point some 5 miles up the Saltoro or Bilafond glacier, but was forced to return owing to the inclemency of the weather, the lateness of the season, and the unwillingness of the Khapalu men to proceed (Vigne, 'Travels in Kashmir,' vol. 2, p. 382). In 1848, Henry Strachey visited the Siachen glacier, from which the Nubra river takes its rise, and forced his way

* Read at the Royal Geographical Society, April 18, 1910. Map, p. 744

up it for 2 miles ('Physical Geography of Western Tibet,' p. 53; also *J.R.G.S.*, vol. 23, p. 53).

It was natural, therefore, that I made this region my goal last year, well assured that nowhere else could my alpine experience be turned to better use. Sir Francis Younghusband, then Resident in Kashmir, and to whose kindly assistance I am indebted far more than I can say, showed me the original field-books and maps containing the records of his explorations at the sources of the Oprang river in 1888. On this occasion he had been despatched on an important mission from which he turned aside for a short time to investigate the native reports as to the existence of a pass—the Saltoro pass—leading into Baltistan. His longitudes depended very largely on the identification of a high peak which he sketched. From the old survey maps with which he had been supplied, it was natural to suppose that this great peak was none other than K_2. But H.R.H. the Duke of the Abruzzi had been able to demonstrate that it was probably Gusherbrum. The latitudes were quite beyond dispute, but in spite of this, we found that the compilers of the well-known 'Map to illustrate the Explorations of Captain Younghusband' had drawn his route much too far to the south in order to fill in the curious blank V-shaped patch south-east of K_2. After a laborious three days' ascent of a glacier, named by him the Urdok glacier, Younghusband camped on the ice at an altitude of 15,355 feet. His latitude was 35° 41′ 20″. Proceeding southward the next day, he saw a gap in the ridge about 3 miles distant. Through this gap he saw peaks rising to the south. His men believed this to be the Saltoro pass. But avalanches made further progress extremely dangerous; and, having ascertained what he wished to know—that there was no practicable route into Kashmir territory—he returned by the way he had come. Before I left he gave me a diagram showing where he considered the main water-parting really lay, and in the end it was found that his anticipations were in almost complete accordance with fact.

My party originally consisted of only Lieut. A. M. Slingsby and myself. At the last moment that well-known mountaineer, Dr. Arthur Neve, of Srinagar, found himself free to join us for a few weeks. I have to thank Colonel M. J. Tighe, D.S.O., 56th Rifles Frontier Force, for his kindness in obtaining special leave for Slingsby to join me, and also for allowing the latter to bring two sepoys, Gulab Khan and Attar Khan, with him. Let me say once for all that their services were quite invaluable. I have also to thank Colonel Longe, R.E., Surveyor-General of India, for his very considerate offer of the services of an Indian surveyor, an offer which I felt unable to accept because all his time would have been wasted had we been unable to cross the Saltoro pass.

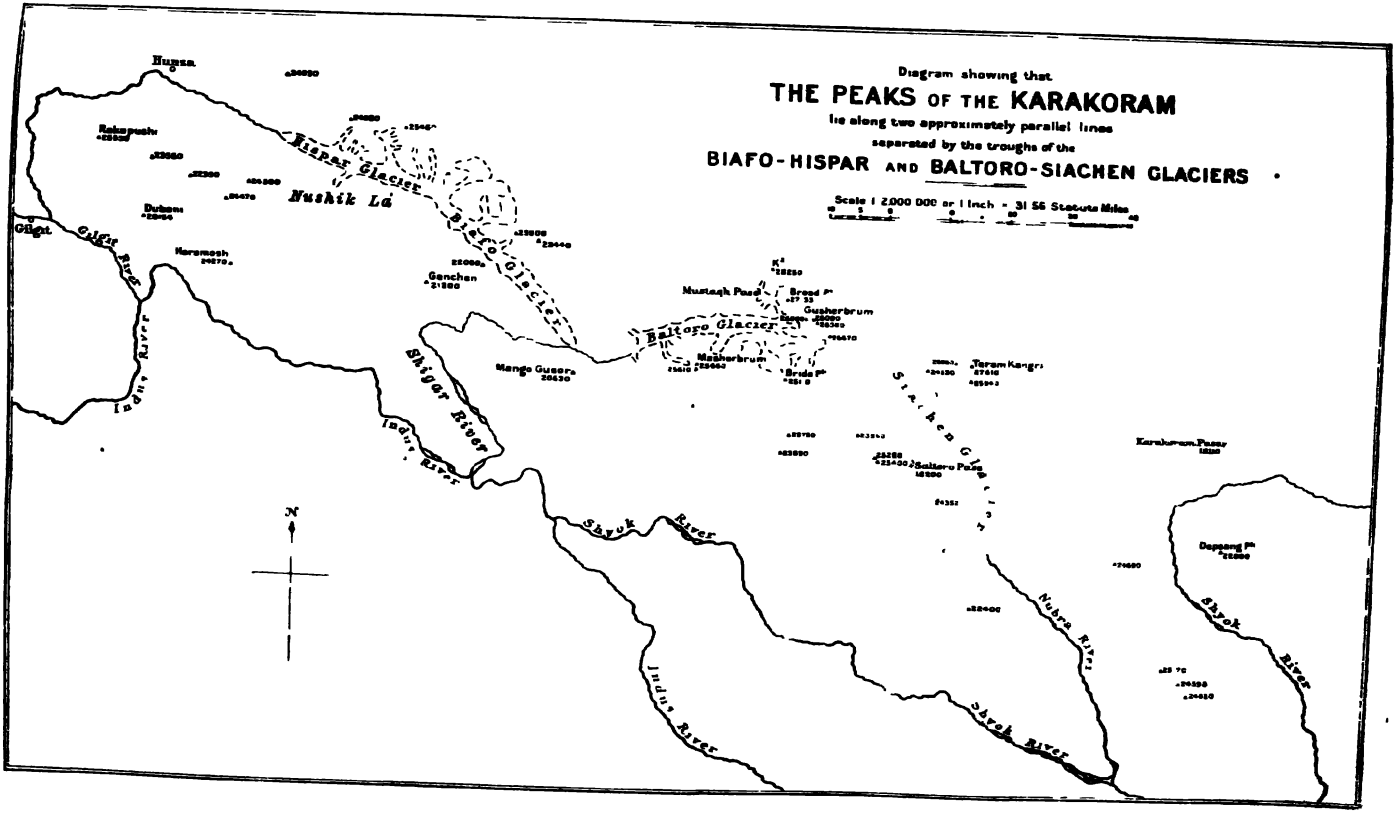
We left Srinagar on May 20, and thanks to the excellent arrangements made for us by Captain D. G. Oliver, Assistant Resident and

British Joint Commissioner for Ladak, crossed the Zogi La (11,300 feet) on May 26 by the winter route, and reached Kharmang on the Indus on June 1. From Kharmang (8150 feet) Neve took the baggage down the Indus to its junction with the Shyok, the Northern Indus of earlier writers, where he ferried across the united streams. Then proceeding along the right bank of the Shyok he reached Khapalu after another exciting passage of the river on zaks.

Slingsby and I crossed the Ganse La (17,100 feet) direct to Khapalu. We were told at Kharmang that the passage would not be possible "until the apricots were ripe." Scenting trouble, we took only four coolies, and when these struck work on the morning of the second day, we sent them home rejoicing, and carried our own loads over the pass, reaching Khapalu (8350 feet) on the third day. Slingsby's orderlies saved the situation. As usual, this lenient treatment of the local people aided us in our future dealings. A traveller gains far more by showing his own superiority over these people than by coercing them, and we never had any more trouble.

At Khapalu, thanks to a letter of introduction from Sir Francis Younghusband, we were most hospitably entertained by Rajah Shere Ali Khan and Rajah Nasr Ali Khan. Shere Ali Khan informed us that the Saltoro pass lay at the head of the Bilafond glacier, and that beyond it were two routes, one leading to Nubra and one to Yarkand. But we were too much obsessed with the ideas imbibed from the study of our maps to appreciate the full significance of this statement. The route was said to have been abandoned when the Leh-Yarkand trade-route *vid* the Karakoram pass was rendered safe by the intervention of the British Raj. But the desuetude into which so many glacier passes across the ranges of High Asia have fallen in recent times is so frequent an occurrence that I cannot accept this explanation. I should rather look for changes in the glaciers themselves, but as I have previously pointed out (*G.J.*, vol. 31, p. 382) by no means necessarily an advance or increase of the ice. Dr. Stein could probably give us some information on this subject. Further, I find that in 1848, Thomson ('Travels in Tibet,' p. 468), in reference to Vigne's attempt, says that he has been unable to find any one who had crossed the Saltoro pass, and that in Nubra all knowledge of any road either to Khapalu or Yarkand was denied.

Neve rejoined us on June 5, and with the ever-ready assistance of Shere Ali Khan we started again for the Saltoro valley on June 7, Abdal Kerim, one of the rajah's wazirs, being sent with us to make arrangements for coolies and supplies. Crossing the spur behind Khapalu, we dropped down to the Shyok, and at Chogogron ferried across to the right bank on zaks. Our route now led us along the south (left) bank of the Saltoro river. Up to Dansam the valley is deep and wide, the river winding along over its flood plain in several


Diagram showing that
THE PEAKS OF THE KARAKORAM
lie along two approximately parallel lines
separated by the troughs of the
BIAFO-HISPAR AND BALTORO-SIACHEN GLACIERS
Scale 1 2,000 000 or 1 Inch = 31 56 Statute Miles
Hispar Glacier
Hushik La
Biafo Glacier
Baltoro Glacier
Siachen Glacier
Nushik La
Gilgit
Gilgit River
Indus River
Shigar River
Shyok River
Nubra River
Saltoro Pass
Mustagh Pass
Gasherbrum
Masherbrum
Mango Gusore
Ganchen
Teram Kangri
Karakoram Pass
Dapsang
Rakaposhi
Haramosh
Diran

channels and sweeping round the bases of several large alluvial fans, each irrigated, and hence presenting a pleasant green contrast to the prevailing brown of the crags on either bank. Opposite Paro sheer spires of granite shoot straight up from the river to a height of 5000 feet or more, forming one of the most tremendous palisades I have ever seen—"one adamantine dominion and rigid authority of rock."

At Dansam the Kondus river from the north joins the main stream of the Saltoro, and there is a considerable rise in the level of the valley-floor, with a corresponding waterfall in the river. This is a constantly recurring feature in both the Karakoram and the Himalaya as the glacier region is approached, and I cannot help referring it to the conservative action of the glaciers which descended to these levels in recent geological times. I find it very difficult to believe that glaciers are capable of the degree of spade work claimed for them by most modern geologists. I cannot conceive that solid water is a more powerful denuding agent than liquid water. The etiology of the "tread and riser" formation seems to me to be more explicable on conservative grounds than by means of the elaborate laws evolved by the advanced supporters of the "plucking" theory. At Palit fragments of the old lateral moraines still cling in sheltered places to the valley walls 1000 feet above the level of the stream-bed. The rocks on the north side of the valley appear to consist exclusively of granites, but the high splintered crest on the south is of slate.

At Goma (10,800 feet), the highest village, we turned up the Ghyari nala towards the Saltoro pass. On the right side of the nala three steep narrow glaciers descend through deep gashes in the granite palisade, terminating among the shrubs of the valley floor. They are all actively advancing. The people say that this has been going on for ten or twelve years. As the snouts are approximately in the position shown on the G.T.S. map (1861), it is evident that there has also been at least one period of local retreat since that date. In this part of Baltistan the word *rüzu* was consistently employed to designate a glacier as apart from snow (*kha*).

The Saltoro valley splits at its head (Goma) into three main glens. The glaciers in these—the Bilafond-Chumik, the Rgyong, and in a lesser degree the Chulung—are of the valley type, which, with the doubtful exception of the Aletsch, is unknown in the Alps. They are dendritic, and in all cases secondary glaciers descend right down into the main valley below the present termination of the trunk-streams.

On June 11 we established our base camp in an extensive thicket a few hundred yards from the snout of the Bilafond glacier (12,400 feet). The place is known as Ghyari, and is annually visited by shepherds. A pair of ibis-billed curlew (*Ibidorhynchus struthersi*) frequented this spot. They were evidently nesting. We did not know that the eggs of this

rare bird had never been found, and so made no proper search for them. Eastern Baltistan and Ladak are relatively treeless countries, and the demand for fuel leads to great destruction of shrubs in the neighbourhood of villages, but it is usual to find a luxuriant growth of pencil cedar, *shukpa* (*Juniperus excelsa*), willow, and tamarisk, with broom, vetch, and borage, and sometimes wild-currant and rose bushes, near the snouts of the larger glaciers. This holds good as far east as the snout of the Siachen glacier in Nubra, but was not observed at the snout of the Remo glacier, where conditions are more completely Tibetan.

In September, 1835, Vigne camped at this spot. Next day he went 5 miles up the Bilafond to a spot he called Ali Bransa, and which is so marked on the G.T.S. map. He was compelled to turn back owing to bad weather. He speaks of there being two lofty ridges to cross, and two or three more nights to be spent on the ice "before the northern end of the Nubra valley is reached." He appears here to refer to the mountain wall which has always been supposed to close the Nubra valley on the north, 20 miles above the snout of the Siachen glacier.

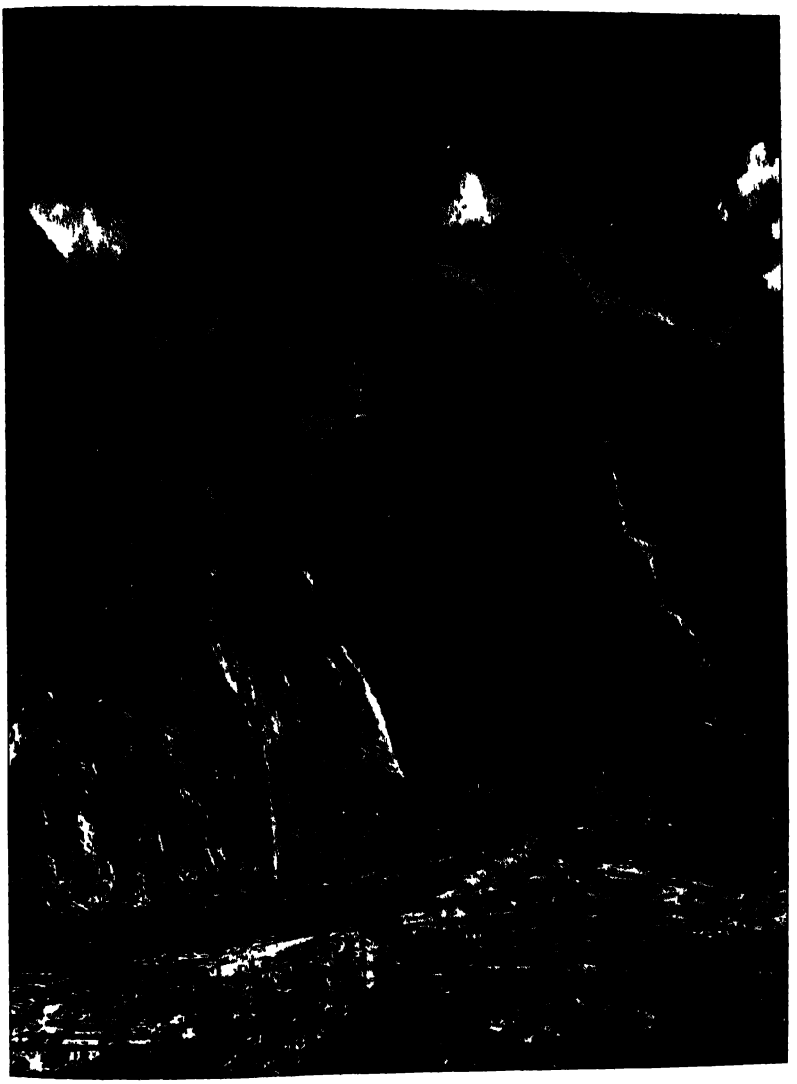
The Bilafond glacier is the most northerly and largest of the three glacier systems from which the Saltoro river heads, and had it not already a well-accepted local name, might well be termed the Saltoro glacier, for tradition and usage have given the name of Saltoro to the pass we had set out to explore, and it was so used in conversation by the Rajahs of Khapalu. But locally the pass is called the Bilafond La. The Chumik glacier has united with the Bilafond, and the ice now definitely enters the main Ghyari nala. This advance has been a matter of local interest and comment for the last ten years or so. The Chumik glacier was said to have joined the Bilafond about fifteen years ago. Comparison with the old survey indicates an advance of about 2 miles of the combined trunk stream. The advancing ice has actually involved the thickets of alder and juniper on its left bank, and has flowed over the sheep-track which led to the little pasture situated there. The glacier appears to be over-topping its lateral moraine, but there was no observed advance of the snout between June 11 and June 27.

After a day's work with the plane-table from a spur (14,900 feet) above camp, we set out on June 13 up the Bilafond glacier. We had eighteen laden coolies carrying tents, provisions, and wood for our party of twenty-five all told. Our headman was Mullah Halim, of Goma, a very fine fellow. Keeping as close as possible to the right bank, we made our way over horribly unstable moraine. Well disposed glaciers leave a road between themselves and their containing wall, but the Bilafond is an overbearing monster, full to the brim, and steadily advancing, piling its moraines in fearful confusion against the very bases of its confining cliffs. After seven hours' grind, having covered 6 miles, we got off the ice on to the steep grassy slopes of the right bank, and camped about the spot marked "Ali Bransa" on the G.T.S. map,

probably after *Vigne*. *The real Ali Bransa is some 6* miles further on. Our camping-place appeared to be known as *Naram* (14,400 feet): there was a clear sight back to my last station.

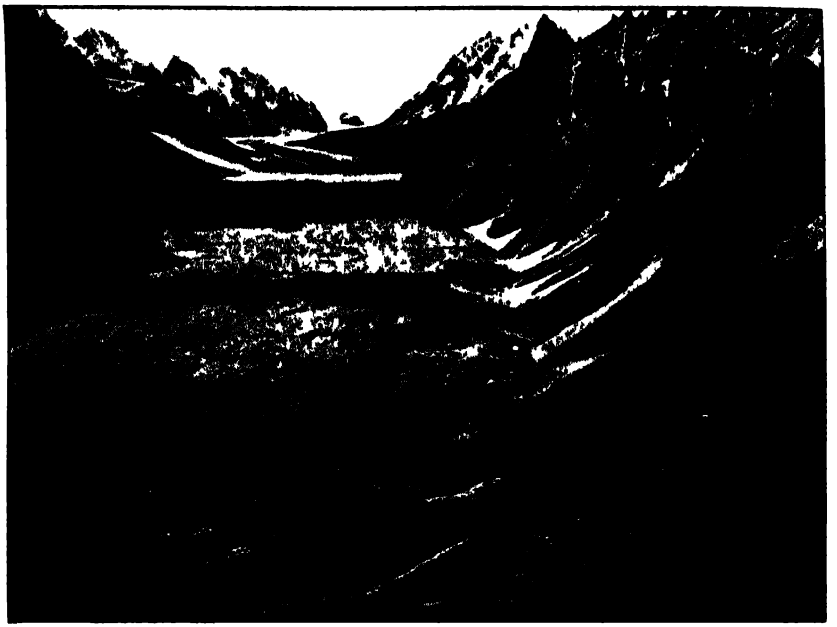
One word as to the old survey. In reference to the Saltoro region, the Report ('Synopsis of Results, G.T.S.,' vol. 7, p. xxxiii$_c$.) states that "Mr. Ryall made a rapid sketch of the country, but with sufficient precision to give a good general idea of its physical formation." This is a thoroughly accurate description of what was done in 1861. No claim is made to a detailed topographical survey. The whole basin of the Kondus and Saltoro rivers was under examination, and it was quite impossible that the glaciers should be explored. The triangulation of the high peaks, on which my map is based, was a very different affair, having been effected several years previously by Montgomerie's assistants with the greatest precision. But none of these points are represented as being on the line of the water-parting; they are all correctly shown to the south or west of it. It should not be necessary to point out that, while a mountain range can only be accurately mapped by means of a theodolite triangulation, it is quite impossible to lay down the actual line of water-parting except by supplemental topographical methods. For the latter class of work the great glaciers of the Kondus valley still remain an almost virgin field.

On June 14 we continued on up the glacier. The going was much better, there being a choice of either the well-made moraines or the clear alleys of ice between them, for, owing to the numerous large secondary glaciers which join the Bilafond, the medial morains are multiple. About the junction of the middle and upper thirds of this glacier these moraines are four in number, and each about 50 feet above the level of the rest of the glacier. This height is not due to the actual depth of moraine stuff, for melting is here greatly retarded, so that the ice is really raised underneath the protecting covering of stones. The ice of these moraine-weals is a clear blue or green, while on the bare surface of the glacier the ice is white and finely honeycombed. Besides the Chumik, two large glaciers enter on the left bank. On the right they are more numerous but smaller. Glacier tables of large size are common, being situated usually beside the raised moraines, from the summits of which they had originally fallen. On the right bank of the main glacier, jutting out from two salient angles, are a gigantic pillar of rock, and about a mile further on an almost equally extraordinary pointed tower. The moraines, and, so far as I could see, the two confining ridges also, consist entirely of granite, and on the right bank the former present an almost continuous palisade of gothic spires. If these were ever covered by an ice-cap, that ice-cap has singularly failed in leaving its mark upon them. It is inconceivable that any re-weathering can have produced forms so abrupt and on so gigantic a scale.

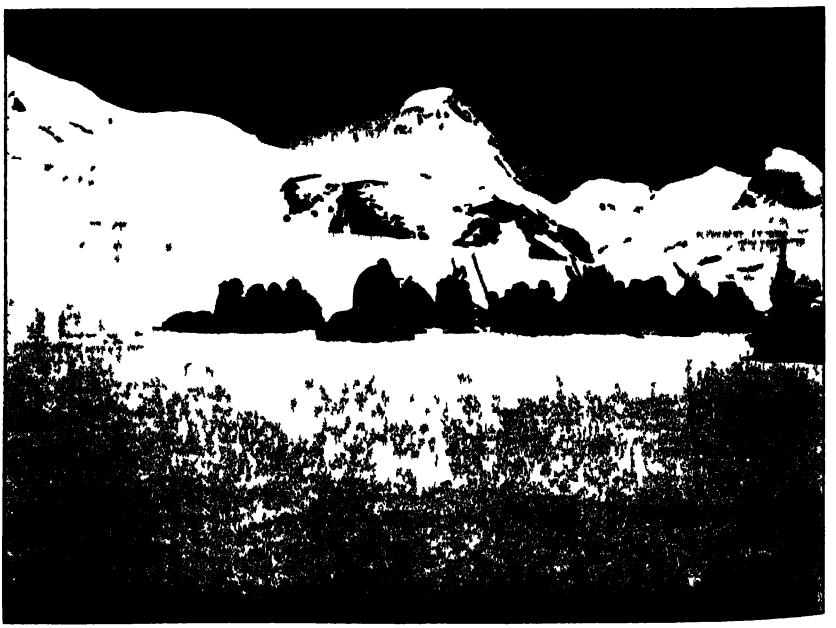


SALTORO SPIRES.

(All photos by T G Longstaff)



THE BILAFOND GLACIER



SUMMIT OF THE SALTORO PASS

As we proceeded the moraines diminished, and crevasses, often covered by sodden snow, became more troublesome, so that we had recourse to the rope. This, of course, delayed the coolies, and it took seven hours from Naram camp to reach the spur on the left bank of the glacier where Ali Bransa was reputed to be. None of our men could exactly locate the old halting-place. In consequence we climbed up a steep slope, and camped in a most uncomfortable and exposed spot (16,700 feet). There were several snow and hail storms, with tempestuous wind all night.

On June 15 we started at 7 a.m. Snow was lying on the ground, and the going was very bad. Regaining the glacier, we soon came to the real Ali Bransa, consisting of three low stone walls (*bransa*) on a strip of solid moraine tucked away under a cliff. The *bransa* yielded not the slightest trace of human occupation. I think it is certain that it had not been visited for at least a generation, for our men could have made themselves fairly comfortable here, instead of passing a wretched night on the exposed spur. Our last camp had involved great labour in building platforms for the shelter tents with which we had provided them. We had constant difficulties with concealed crevasses, but of course were roped together in suitable parties. At 9.30 a.m. we reached the foot of the steep slope leading up to the pass, and the coolies going very well, reached the summit (18,200 feet) at 10.50.

The summit of the pass consists of a level snowfield with a very gentle slope towards the north-east, succeeded by a steeper drop. There was thus a good deal of dead ground on either side of us, which, added to the clouds already covering the highest peaks, considerably detracted from the results obtained by camera and plane-table. We could see that from our pass a broad glacier led gently downwards in a north-easterly direction, and joined a still larger glacier at right angles, which at first seemed to us to flow northwards, we supposed into the Oprang valley through some gap in Younghusband's wall. But that same afternoon we approached sufficiently near to see that the main glacier was flowing to the south. Beyond this was a wall of very lofty peaks, their summits hidden by cloud, which we assumed formed part of the Aghil range. We very naturally believed that we had crossed the main divide of the Karakoram, and that therefore this huge ice-stream must curve round to the east and discharge into the Yarkand river. At 11.50 we began the descent. The snow was appallingly soft, and the leader sank to the waist at every step. Crawling on hands and knees scarcely relieved the labour, and even when some sort of a track was broken it was grinding work for our laden coolies, who wished to camp on the snowfield until the night frost hardened the crust. However, they persevered manfully, and at 4.30 we camped (16,900 feet) on bare ice close to the birthplace of the right lateral moraine. The creaks and groans emitted by the slowly moving ice so

frightened our men that, in spite of the cold, they left their tents and passed the night huddled up in the open.

Next day we made only a short march. It was impossible to get off the ice on to the right bank, owing to a confusion of huge seracs and impassable crevasses. We eventually camped at the spot where the left lateral moraine of our glacier effected a junction with the right lateral moraine of the main ice-stream (15,875 feet). Here there was a depression in the glacier-level, and an inexhaustible supply of stones to lay on the ice under our tents. Water was obtainable from surface pools close at hand. Two coolies told us that they had heard of this glacier, and that it was called Tĕrăm (or Teṛm). They said that it would lead eventually to "Chang Thang," by which I concluded they meant the country north of the Karakoram pass. We naturally christened our glacier "Teram glacier," being quite unaware of the fact that it was really the undiscovered upper portion of the Siachen glacier of Nubra.

From our camp we now saw that we were upon an enormous glacier, fully 3 miles in breadth, and by far the biggest any of us had ever seen. It was flowing from north-west to south-east, or approximately from the direction of Conway's "Hidden peak." Near its head and distant about 15 miles was a gap, which I at once connected with the sketch of Younghusband's "Saltoro pass" which I had seen in his report. It is possible that in former times there was a route from the Oprang valley over Younghusband's saddle, and either down the upper Siachen into Nubra, or into Baltistan over the true Saltoro pass, or by some other pass over the Kondus ridge. But I cannot believe that natives would ever have undertaken so dangerous and arduous an enterprise; for we had been told that animals had never crossed the Saltoro pass, and thus travellers from the Oprang side would have had to carry their own food and fuel on their backs, possibly from Raskam. Under the best conditions, the passage of the glaciers alone could not have occupied less than a week. I believe that the Saltoro pass was never used except as a short cut from Baltistan into Nubra. If a direct pass from Nubra to the Pamir formerly existed, it is almost inconceivable that Muhammed Haidar should not have crossed it in 1535, when the treachery of Rashid Sultan compelled him to seek safety in Badakshan, and when, in fact, he fled from Ladak by way of the Karakoram pass and Raskam. It should be noted that both Hayward and Gordon refer to an old pass leading from the head of the Kufelung glen into Nubra, necessarily *viâ* the Siachen glacier. On our side a great secondary glacier swept gently down from this very direction.

None of the trigonometrically fixed peaks of the G.T.S. were visible, and although I had carried my plane-table sketch down to this camp, so sceptical was I of its accuracy, owing to the many difficulties I had had to contend with, that I decided to start afresh with a new base-line on the approximately level surface of the main ice-stream. This was

accomplished on June 17 with the indispensable assistance of Neve and Slingsby. From the two ends of this base I roughly sketched in the topography of the 25 miles of glacier in view, and took altitudes to the principal peaks. Meanwhile Slingsby despatched Gulab Khan with our two best Baltis down the glacier. They were absent over 13 hours. On their return Gulab Khan reported that they had descended for 7 or 8 miles, but had seen no indication of the termination of the glacier, and further that it showed no intention of turning to the east, but even turned still more to the south. They brought back a primula, a sedum, and a saxifrage, and reported having seen ibex on the east bank. They also said that the main surface stream was quite impassable a few miles below our camp.

Pyramidal ice-pinnacles as much as 3 feet high are a great feature of this glacier. The surface of the ice was also honeycombed to an extent I have never seen in any other mountain region. The hollows were round or oval, having a level bottom, floored with a sprinkling of stone fragments, varying in size from slaty slabs about 6 inches in diameter to fine grit, and covered by 1 to 6 inches of water. The edges rose steeply from the bottom in beautiful fluted cones to a height of from 6 to 18 inches. A spirited attempt has recently been made to classify as nieves penitentes all sorts of varieties of ice and snow pinnacles prevalent in the Karakoram, including even "glacier tables." I hardly think the position is tenable, because the genesis and composition of so many of these structures are so different to those of the well-known Andean formation. Hooker, in 1848, appears to have been the first to notice these cones in the Himalaya (*Himalayan Journals*, vol. 1, p. 252).

Owing to the numerous large secondary glaciers which join the trunk-stream on either hand, there are four moraines (possibly five) which may be termed medial moraines. Those on the right half of the glacier appeared to consist entirely of various granites, and are of a uniform light grey or brown colour. This was in accordance with our observations of the petrological character of that range of the Karakoram across which we had passed. But from the moraines on the left half of the glacier we obtained specimens of hornblende schist, mica schist, dark slate, and white or grey marbles of various kinds, some of the latter being of exceptionally good quality. Gulab Khan also brought back a beautiful fragment of alabaster from near the left edge of the glacier. Thus in marked contrast to the light greys and browns of the right moraines, those on the left presented a much darker hue, appearing almost black in contrast to the blocks of white marble scattered on the surface. The latter appear to be derived from the upper section of the central peaks, while the lower strata of the range appears to be of slate and dark schists. Altogether we seem justified in assuming that the valley is a tectonic one.

The huge wall of peaks * to the north-east was obviously of very great altitude, as Burrard had predicted. But it has been very truly said that the discovery of a new peak is of little interest or importance unless its actual height is ascertained, and I must therefore anticipate somewhat by giving the results of my measurements of the highest point in this new cluster, which I have named Teram Kangri. I got a good sight of it from the west end of my base-line, but by the time I got to work with the clinometer at the east end, the highest peak was in the clouds. I got another sight from the Saltoro pass on my return. I estimated it at the time as being over 25,000 feet; but when my observations were worked out at Dehra Dun, its altitude appeared to exceed that of Everest. This was too much for Colonel Burrard, in spite of his own prophecy. The angles which the peak subtended could not well be called in question, for the Indian Survey clinometer is a very simple instrument and quite easy to use. I tested it at Dehra Dun, observing to the neighbouring hills against another observer with a theodolite. But the determination of the exact location of the peak really depended on two rays only—those from the two ends of my 1000-yards base-line; for the third ray from the Saltoro pass was of little or no additional value. My distance from the peak was, therefore, quite likely to be in error, and, after consultation, I moved the highest peak 2 miles and the second highest 1 mile nearer to my observing-station. The result of this manœuvre may be tabulated as follows:—

Angle from station.	Distance from peak.	Altitude above station.	Altitude of observing station.	Observed altitude of peak.
10° 50′	12 miles	12,200 feet	16,000 feet	28,200 feet
4° 50′	20 „	9,150 „	18,200 „	27,350 „

It is to be noted that the value 18,200 feet given for the Saltoro pass is deduced from Watkin aneroid observations (*v. post*). The angle by clinometer from my base station gave to the pass a height of 18,780 feet. If the latter value be accepted, the value for the second observation would work out at 27,940 feet. On July 2, from the summit of the Rgyong La (18,700 feet), Slingsby and I saw to the northward a group of very lofty peaks, far overtopping the general level of the snowy ranges spread before us, which we identified as the Teram group. Owing to the anticipation of greater difficulties than we actually experienced, we had taken no coolies with us, and I had shirked carrying up either my large clinometer or my plane-table. Nor did I, indeed, expect to see these peaks, for I had not realized the probability of their extreme height. I had with me a small geological clinometer, with a swinging arm. For greater accuracy I rested this along the straight edge of my ice-axe, while Slingsby read the dial half a dozen times.

* The dip appeared to be towards the north-north-east.

We made the angle about 3° 40′. The Rgyong La is 33 miles from the peak according to my map. Were these figures correct, the peak would work out at something like 30,000 feet. But with such rough methods the probability of error becomes a certainty. Yet this observation, crude though it be, combined with the photograph of the group taken from the same spot and which I have shown on the screen this evening, tends to confirm my previous results. After full allowance has been made for a slight downward tilting of the camera (f.l. 118 mm.), the highest peak still appears to rise at an angle of at least 3° above the horizontal. This is equivalent to an altitude of about 27,700 feet. But considering that the discrepancies between the different observations are very considerable, I wished at first, for obvious reasons, to suppress the actual figures I obtained, and to content myself with saying that the peak was a very lofty one. I was subsequently advised to publish the figures for what they are worth, and to give the nominal value 27,610 feet to the peak; but it must be distinctly understood that the Survey can take no responsibility for this or any other of the results I am putting before you. They have, however, accepted my nomenclature, which is in conformity with the advice officially tendered to travellers by this Society. The Tibetan form Kangri, instead of the more correct Ladaki form Gangri, has been adopted for the sake of uniformity with modern usage, as in the case of Aling Kangri, Kulha Kangri, and so on.

I have thought it well to deal fully with my reasons for attributing so great a height to an unknown peak. Not since 1858 has a peak approaching this height been discovered. It is to be noted that, until last year *all* those mountains known to exceed 27,000 feet have been brought to light by the scientific operations of the Survey of India. If Teram Kangri attains such a height, it seems to me incredible that it can have eluded the theodolites of Montgomerie's surveyors. Yet at its feet winds one of the greatest glaciers in High Asia, unsuspected until last year. That Teram Kangri has been seen before, probably by Neve and Oliver from the Murgisthang saddle, and possibly by Ryall, I cannot doubt.* Hayward must have seen it from the north (*op. cit.*, p. 57). But its remote inaccessibility and the screen of high peaks west and south of it appear to have prevented its identification, though its existence was obviously suspected by Burrard.

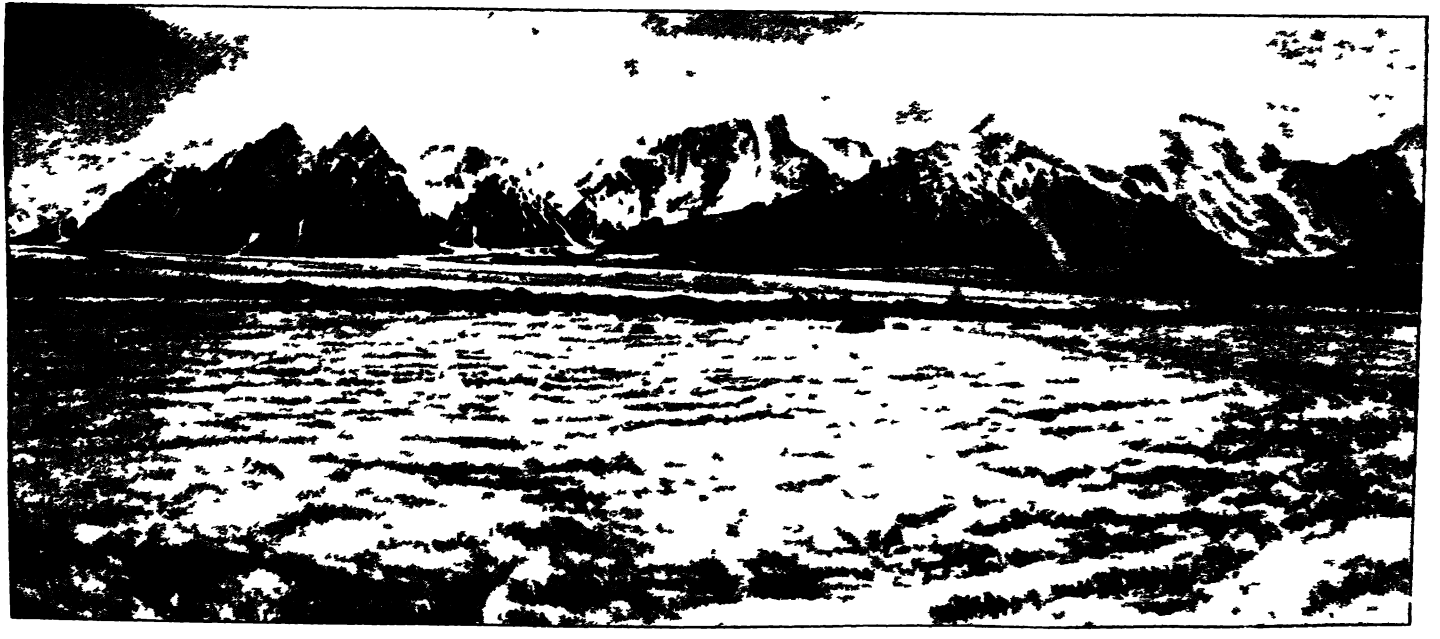
When I had first planned this expedition, my idea had been to force a pass over the range which has always been shown at the head of the Siachen glacier, from upper Nubra into the head of the Oprang valley, and endeavour to return from thence by the Saltoro pass. But Neve and Oliver had already attempted to reach the Siachen glacier, and they entertained the project of renewing their explorations there in the autumn of 1909. Though they offered to waive their prior claims in my

* Apparently also by Sir Martin Conway and Major the Hon. C. G. Bruce from Pioneer Peak.

favour, I accepted their suggestion that Slingsby and I should attempt the Saltoro pass first. We hoped by this means to effect a practical junction of our routes, even if both parties were compelled merely to retrace their steps on the return journey. Neve and Oliver accepted the Survey map as essentially correct, regarding the Siachen basin. It will thus be seen that we were all thoroughly obsessed with the idea that there was a mountain barrier between our "Teram" glacier and the Siachen, and believed that, in spite of all appearances to the contrary, the outlet of our glacier must be towards Kufelung and the Yarkand river, an uninhabited region quite destitute of supplies. Under such circumstances, it seemed unfair to compel the coolies, already becoming alarmed, to continue down the glacier, and we decided, wrongly as it turned out, to recross the Saltoro pass back into Baltistan. Remembering our former difficulties, we realized that a heavy fall of snow would cut off our retreat, or at least retard it for more days than our supplies would hold out. So as the night of June 17–18 was clear and frosty, we decided to rush the pass while all was well, and at 5.20 a.m. on the 18th we started back, roping up before we left camp. The coolies went very well now that their faces were turned towards home, and, taking a much better line on the glacier, we regained the Saltoro pass at 10 a.m., having come very fast all the way. I set up the plane-table and clinometer again, but had no time for photography. Luckily, my head was aching sufficiently to enable me to dispense with lunch! On the far side the snow was already in bad condition, and the weather threatened a storm; but, by forcing the pace, we had the satisfaction of reaching our old camp at Naram in twelve hours from the start, where we much appreciated sleeping once more on solid earth. On the 19th we gave the coolies a day's rest at Naram. Neve botanized; Slingsby went off after a herd of ibex; and I went a few miles up the large secondary glacier, which joins the Bilafond opposite Naram and appears to rise in the snowfields of K_{12}, an elusive peak which I was never able to identify to my entire satisfaction. It snowed most of that afternoon and all the following night, rendering the descent of the moraines to Ghyari more exasperating than ever, and we felt we were well out of what might have been an awkward fix.

The task we now set ourselves was to find a pass over the head of one or other of the Saltoro group of glaciers which would lead us down directly into upper Nubra. The only known way into that valley would lead us back to Khapulu and up along the Shyok to its junction with the Nubra river, a very trying route at this time of year.

On June 23 we set out up the Chumik ("water-eye" = spring) glacier, camping at 15,500 feet. Its southern boundary is formed by a serrated wall of unscaleable peaks draped with traceries of fluted snow of indescribable beauty, but literally raining avalanches on to the glacier below. The rocks were composed of various granites, but



TERAM KANGRI ACROSS THE UPPER SIACHEN GLACIER



LOOKING DOWN THE UPPER SIACHEN GLACIER

from the middle moraine I obtained specimens of actinolite schist and a badly weathered dyke rock (? minette).

The character of the Chumik glacier was in general very similar to that of the Bilafond. The pass at its head was obviously much too steep for coolies, and greatly to Slingsby's disappointment we did not attempt it, but contented ourselves with mapping and photography. On our return journey to Ghyari (June 25), Slingsby and I reached a height of 17,150 feet on the steep ice-fall of the upper Chumik glacier north of our last camp. The danger of avalanches from the peaks above prevented our reaching its highest *névé*, but I have ventured to reduce its area very considerably on my map. Nove had now to return to Srinagar, and we parted at Goma on June 27 with mutual regrets. The influence of his reputation as a healer had been of the greatest use to us in our dealings with the Baltis. His skill in the operation for cataract, which he performs by the roadside with the greatest success, is an inestimable boon to these people. It was an honour to be associated with him in such work, in however slight a degree.

At Goma we heard that there was a tradition of a route into Chorbat (Shyok valley) over the head of the Chulung nala. But we decided first to thoroughly explore the Rgyong valley. We accordingly left Goma on June 29, and crossing the Saltoro river by a temporary and extremely rickety bridge, entered a peculiarly narrow and steep-sided defile, and ascended beside a series of waterfalls and cataracts. The gorge, as usual, opened out higher up, and the river wound broad and shallow over a gravel flood plain, cutting the bases of several *débris* fans.

Our camp (13,250 feet) was pitched among stunted willow, birch, and pencil cedar, below the first large glacier descending from the north. On later examination this proved to be in a state of active advance. It terminates in a perpendicular wall of ice, finely castellated at the two sides, and from which great blocks of ice constantly roll down into the scrub jungle at its foot. On June 30 we continued up the valley, reaching the main glacier after about an hour's walking. We found the snout about a mile below the point marked on the Survey. It had all the characteristics of active advance, but there was no observed advance of the snout between June 30 and July 3. We kept along the right edge of the glacier, making use of the lateral moraine as much as possible. As a rule, the glacier filled the nala from edge to edge, but occasionally we could travel in the hollow between the moraine and the valley wall. On one such spot (15,000 feet) we camped early in the afternoon to take shelter from an impending storm. We had had light snow squalls all day long. On July 1 we soon reached bare ice, where the going was easier. In two hours we reached the point (15,850 feet), where the glacier divides into two great arms. One flows from the two Survey peaks, 21,720 feet and 20,960 feet, to the south; and the other swept down from an invisible saddle to the

north-east. The latter was obviously our goal, and we camped on the highest available spot (16,700 feet) on the right bank. Just above us we noticed an old native cairn. It was the highest spot on this trip at which we saw the little mouse-hare, a friendly beast, very aptly named *shippi*—"the whisperer."

Next morning, taking only two men with us, we started at 5.45 for the Rgyong La, as we named our hypothetical pass. We expected considerable difficulties, but except for some fatiguing step-cutting we raced up without a hitch, and reached the pass (18,700 feet) in very good time, at 8.40. The rocks of the crest are granite. To my great surprise we found the remains of a cairn on the summit, so that probably the pass has been crossed by natives. We looked down on to a feeder of the Siachen glacier of Nubra, but the descent is extremely steep, and we were not willing to risk the lives of our coolies by making them carry our heavy baggage down it. The panorama spread before us was a magnificent one. To the west we looked back over the mazes of the Rgyong glacier. To the south was a sea of magnificent peaks separating us from the Shyok valley. But it was a vista of distant snows, through a break in the hills to the north, that held our attention. There a group of four peaks far over-topped everything else in sight. We had no doubt that this was the massif north-east of our "Teram" glacier, but until this moment we had no idea of their commanding altitude. I took bearings to these peaks, and also to K_{19} and K_{32} of the Survey map. Presuming that these two latter identifications were correct, the observed position of Teram Kangri agrees with that shown on my map. It is extremely unlikely, for many reasons, that the high peaks we saw were any others than the Teram Kangri cluster. I have already detailed my attempt to measure the highest peak.

After spending an hour and three-quarters on the pass, we descended rapidly to our last camp, and striking it at once, the whole party started back down the glacier, reaching our first glacier camp (15,000 feet) easily by 5 p.m. On the way down we witnessed a fine glacier burst. It was heralded by a loud and prolonged roaring sound, quite unlike anything I have ever heard. We soon located it, bursting from a side glacier in a ravine high above the right bank of the main ice-stream. The whole hillside seemed to be moving, as a torrent of black muddy water rolled great masses of ice and rock down its bare slopes. We found our camping-place, a low sheltered spot beside the glacier, had been very nearly flooded by the torrent thus set loose. Next day we ascended a prominent spur (16,070 feet) to examine the great secondary glacier marked on the survey map as discharging into the Rgyong Valley on the north-east. But again, as with the corresponding branch of the Chamik, I was constrained to reduce its area very greatly. We marked our station with a large cairn, visible from the valley below. On July 4 we again reached Goma village.

The Chulung ("water-valley," or valley of streams) was now the only remaining terminal of the Saltoro valley system to be explored. We left Goma for the last time on July 6. There was the usual steep rise beside a waterfall from the level of the Saltoro river into the Chulung gorge, where the Chulung river has cut out a fine cañon. The right bank of the cañon is of granite, and the left of slaty schists, and lying beside the torrent are boulders of beautiful green serpentinous and mica schists. The latter probably came from the ridges to the south-west, and are no doubt ice-borne. Several secondary glaciers are visible in ravines on either side.

The magnificent granite spire of Gharkun (17,060 feet) was constantly in view as we ascended the valley. A second steep rise brought us into the open upper valley. We camped at Malla Mani, the highest hamlet (13,400 feet). It is, of course, only occupied during the summer. The grazing is good, but there are no shrubs at this altitude, and fuel has to be fetched up from lower down the valley. Marmots and ibex are numerous.

After three days' rain the weather cleared, and we started on up the nala with 28 coolies. The Bawoni glacier, advancing from the south-west, has descended right into the valley, and abuts against the right bank of the nala a little below the Beltus glacier, where a bed of phyllite underlies the prevalent granites. At no other spot did we see such a profusion of flowers—acres of ground were completely carpeted with eidelweiss, over which flew flocks of buntings. We next passed along the edge of an old lake-bed through which the stream wound in several channels to force its way eventually under the ice-barrier of the Bawoni glacier. Snow fell heavily, and we camped at noon (14,300 feet) below the granite walls of Gharkun. Opposite our camp a small but very beautiful glacier descended almost to the valley floor, ending in green cliffs of ice.

Slingsby discovered a fine glacier pass at the head of the main Chulung glacier which would obviously lead us over into Chorbat, and on July 10 led me and his two orderlies from our camp to the summit (18,300 feet) in 5 hours 40 minutes. From the pass a small portion of the Teram Kangri group was visible to the north, but at this distance (45 miles), and with so limited a view of the range, I was unable to identify the actual peaks in sight. To the south we looked across to the ranges beyond the Shyok river, and beyond these thought we recognized the two great peaks of Nun Kun. The descent on the south side of the pass, which we named the Chulung La, led over steep rolling *névés* and seemed practicable for laden coolies. We therefore decided to attempt its passage with our entire caravan. While waiting for fine weather and to collect food for the coolies, I worked a good deal at my map, and find a note in my diary under July 11, to the effect that our Teram glacier seems likely to turn out to be the Siachen.

On July 12 we got under way at 7 a.m. with thirty coolies led by Abdal Kerim, secretly hoping to cross the pass that day. As usual the coolies lost a lot of time by sticking to the lateral moraines instead of taking to bare ice. By noon we reached the highest possible camping-place, which looked so desolate and forbidding that the coolies were easily persuaded to try the pass that day. I went on ahead with Ahmedu, the only decent Kashmiri of this class we had encountered, in the hope of doing some more plane-tabling, but I did not reach the pass till 2.45 p.m., by which time clouds greatly interfered with my work.

On Slingsby and his two orderlies, ably supported by Abdal Kerim, fell the trying task of assisting and persuading the coolies to face the steep snow-slopes, now softened by the heat of the day. I think very few men would have succeeded as he did. By 4 p.m. all five parties were close to the pass, and I started down to mark the route for the descent. The snow was very soft, and the glacier soon degenerated into a maze of crevasses concealed by a most deceptive covering of new snow, through which the heavily laden coolies were constantly breaking. I quite expected that we should have to spend the night upon the Korisa glacier, but just as it got dark Slingsby found a way off the ice through the difficult seracs on the right bank. We ourselves waited till the last coolie had reached solid ground, and quitted the ice at 8.45 p.m. (16,100 feet).

Our arrival at the hamlet of Korisa next morning created great surprise among the shepherds there. The men are of the Ladaki type, but Mussulman and not Bhuddist. After a long walk we dropped down a deep descent into Chulunka village (9350 feet) on the Shyok river, along the right bank of which we were to travel 50 miles. Between Siksa of Chorbat, and Thirit of Nubra, a distance of 80 miles, the Shyok is unbridged, but it is possible to cross on zaks where the latter opens out opposite Deskit, just below the entrance of the Nubra river.

The track is extremely bad between Chulunka and Biagdangdo, and the coolies were unable to carry their loads across one particularly awkward parri. Here we took two hours to make 300 yards, and nearly lost a coolie, who was hit on the head by a falling stone. Attar Khan caught him as he fell, or he would have dropped straight into the Shyok, roaring in full flood below, The chief villages are all on the northern bank, where alluvial fans are irrigated by means of the lateral streams descending from the glaciers to the north. Barley, buckwheat, and apricots are the chief produce.

At Biagdangdo we left the river-bank to visit Waris, reaching the first Buddhists at the farm and chorten of Zdongpolas, 12,494 feet, for we now enter Lower Nubra. Here we saw shapu (*Ovis vignei*); this is possibly the first record of its occurrence north of the Shyok; their ancestors probably crossed during some very hard winter. Continued bad weather prevented us from attempting to find a pass from the Thusa

glaciers into Upper Nubra, and on July 20 we descended again into the Shyok valley. On this day our route lay along the Chunik La ridge past the "La Chunik Pole, 13,470 feet" of the Survey. From this point the view up and down the wild Shyok river hemmed in on either side by mile after mile of gaunt brown crag, is indescribably grand, its unrelieved and elemental savagery producing in an unusual degree a feeling of exaltation and intense remoteness from humanity.

Beside the Pastan stream we encountered deposits of boulders and gravel cemented together with fine hard silicious mud. These beds were obviously quite different to the fluviatile deposits we had seen high above the Indus when approaching Kharmang. The larger boulders are angular or faceted. Some of the largest capping typical earth-pillars. The commonest rocks represented are hornblende and other granites, but I also found conglomerate, calcareous schists, quartz with chrysocolla, calcite with a little malachite, and red jasper. A careful search yielded no trace of shells or other organic remains. The bed rock forming the sides of the nala turned out to be metamorphic, a highly silicious greenish limestone. These beds must be of glacial origin. We passed other deposits, apparently quite similar, further up the Shyok valley. In the Nubra valley they are never out of sight. They are seen hanging like martins' nests in sheltered spots to the bare rocks of the slopes above the river, and about 1000 feet above its present level. In the Upper Nubra valley itself they were occasionally so continuous on both sides of the nala as to make me think they were the actual remnants of the lateral moraines of the glacier which formerly filled that valley.

We struck the Shyok river again just as it gathers itself together to dash through a very precipitous defile cut in the living rock. The narrowed waters sweep over an obstructing ledge, a portion of which, even at this time of flood, formed an islet in mid-stream. From this point onwards to the junction of the Nubra with the Shyok the valley gradually widens out, until at Deskit the river-channels spread themselves over a breadth of 2 miles. Horizontal beds of fine gravel and sand, especially on the south bank of the river, appeared to point to a former lake-like expansion of the river before the defile was sufficiently deeply eroded to carry off the full volume of water. Several curved bays in the wide flood-plain were covered with sand-dunes on which a scanty growth of tamarisk maintained a precarious foothold. Beyond Mondari the valley presents a wide open prospect which was most pleasing to us after the confined granite trenches of the Saltoro region. Great bushes of wild lavender, with a constant succession of Buddhist chortens and mendongs, added to the picturesqueness of the scene. The banks are quite arid, except where irrigation is possible; but beside the river are dense jungles of amber-berried hippophæ full of small birds, chakor, and hares.

On July 22 we made a twelve-hour march from Mondari to Charasa, rounding the bold rocky promontory, at the foot of which the Nubra river enters the Shyok at an unusually acute angle. Taking the average courses of these two rivers, the general angle of junction is 50°. The angle at the great south-to-west bend of the Shyok, 50 miles further upstream, is also acute, being about 60°. It is evident that the valleys of the Nubra and the Shyok, like the Indus valley, are tectonic. Drew observes that the rocks on the east side of the Nubra are of light brown granite, while those on the west are of a different and much darker crystalline rock. Glaciers have left their marks in these valleys, but the rivers were antecedent.

As we approached the Nubra-Shyok junction at the steep corner mentioned above, we continually passed beds of relatively recent moraine stuff with perched blocks. The solid rock for hundreds of feet above the river was polished, rounded, and scratched at this point of pressure. But the very convexity of their form shows how relatively slight has been the erosion. The striæ showed that the glacier had swung round the corner into the Shyok valley without any alteration of level, just as the river does now. This more than confirms Drew's surmise that the great Nubra glacier must have extended as far as the Shyok valley. On the floor of the Nubra valley itself are many islands of hard rock ("metamorphosed slate," Drew) perfectly worn into polished *roches moutonées*, which have resisted through unknown ages the passage over them of a glacier at least 1000 feet in depth. Whymper pointed out long ago that *roches moutonées* cannot be signs of great erosion, for *flat* and not convex forms are thereby produced. Drew gives the glacier a depth of 4000 feet, but I think some of his arguments can be accounted for by the action of the very large secondary glaciers which must have joined the trunk-stream from the lofty ranges on either side of the valley. The chief lateral glens which I saw or visited may all be described as hanging valleys, their lowest sections having been cut down by water now given a free hand by the retreat of the ice. As a result, the mouths of great lateral valleys such as Chamshing, Popache, and Thalambuti appear quite insignificant when seen from the main valley.

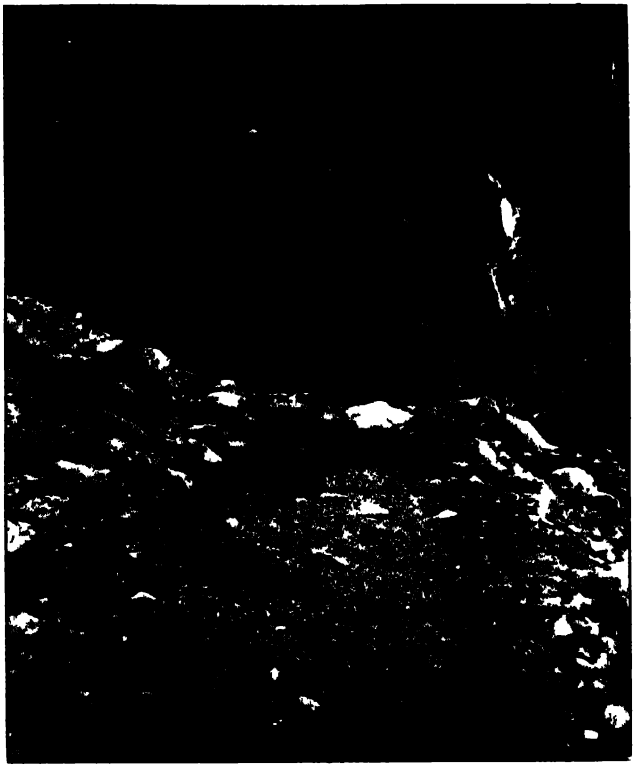
Charasa is situated on one of the ice-worn rock islands I have just mentioned. It is the ancient capital of Nubra, and probably that "Mutadar" which Muhammad Haidar captured with some difficulty from Bur Kapa (? Bagra Mir-Francke) in 1532. Here we unsuccessfully attempted to ford the Nubra river. Its very size might have led us to expect that the Siachen glacier was much larger than is shown on the Survey map. For though the Nubra river has a course of only 45 miles, and receives no tributaries of any importance, the water was sweeping down with a very rapid current through numerous channels covering about a mile in width, and in some of these with a minimum



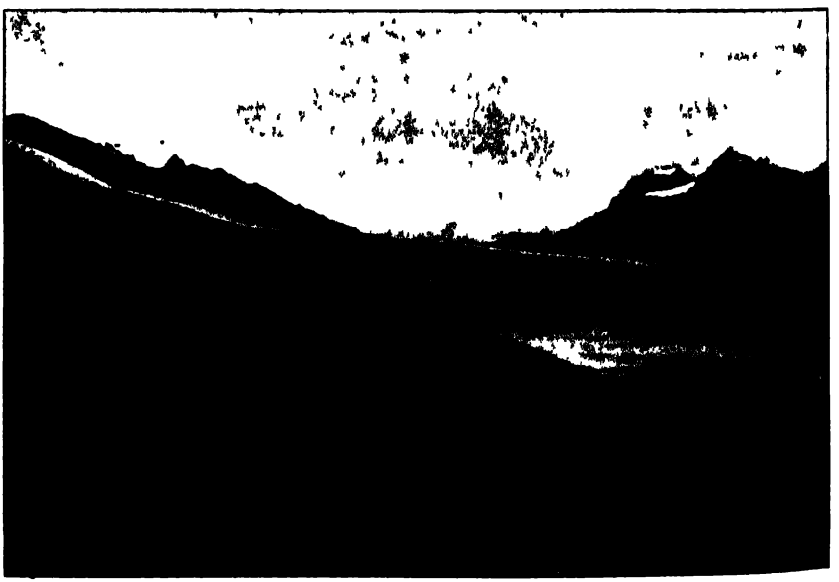
LI RAM KANGRI FROM THE RGYONG LA



LOOKING UP THE LOWER SIACHEN GLACIER



AKTASH GLACIER LYING ACROSS ROAD



GENERAL VIEW OF AKTASH GLACIERS FROM SOUTH.

depth of over 4 feet. It was the strength of the current that really stopped us. However, we managed to cross the river just below Kubet on July 25. Fortunately for us some fifty ponies and yaks belonging to the Nubra people were waiting to cross to Panamik, the highest village of any importance in the valley, where they would be hired out to the Yarkandi and Khotani merchants. We entered the river at noon, and the passage of the different channels occupied three hours. We reached the eastern bank just below the village of Panamik, and about 2 miles lower down than the spot where we first took to the water. One pony was swept away, but managed to make the western bank a mile or so lower down. We were most ably led by the Trampa of Kubet, and a most resolute lama, against whose spells the demons of the waters were powerless. Oliver had most kindly sent news from Leh that we were coming from the west, and had given orders that we were to receive all possible assistance.

The upper Nubra valley was visited in 1821 by Moorcroft, that extraordinary man whose end is still shrouded in mystery; by Vigne about 1835; by Thomson, the first European to reach the Karakoram pass, and by Henry Strachey, in 1848; and later by Drew, whose general description of the valley has never since been improved upon. I will, therefore, only refer to one excursion that we made from Panamik. This was to the glaciers under the great Nubra-Shyok peak 25,170 of the Survey, the Changlung Gipfel of Hermann Schlagintweit. We left most of our baggage at Panamik, and on July 28 entered the Pokachu ravine, or Popache lungma as it is locally called. As usual, the comparatively broad open upper valley is reached through a deeply cut rocky gorge, through which the glacier torrent tumbles in a series of tumultuous cascades. This defile is quite impassable for baggage animals; indeed, it is only just practicable for laden coolies. Instead of a more or less even valley-slope from the water-parting to the Nubra river, we have a hanging valley with a step-like descent, each step representing, as I take it, different levels, and possibly different cycles of glaciation. The head of the valley is divided into two main branches, each holding a large glacier; these sweep round a salient spur, behind which, and at the foot of the culminating peak of the range, their névés are almost in contact, the result being a nunatak. Unfortunately, I selected the northerly of these two glens, and beside its glacier (16,500 feet) we camped on July 29. Continuing up the glacier next day, we camped on bare moraine at 18,200 feet. Here the weather stepped in, snow falling steadily for twenty-four hours, and we were finally compelled to beat a retreat to Panamik on August 1. The highest peaks, best approached from the south-west, presented some steep faces of exposed rock. This was very light in colour, and possibly composed of calcite or marble. On the moraines of the southern glacier I collected specimens of white and green

marble, very similar to the specimens obtained from the upper Siachen ("Teram") glacier. The valley visited by Neve, Millais, and Tynedale-Biscoe in 1899, from the uncharted glacier at the head of which they ascended Panamik peak, 21,000 feet, lies between the Popache and Chamshing ravines directly behind the village of Panamik (Neve's 'Picturesque Kashmir,' p. 140). I have indicated this glacier on my map.

The weather had been most disappointing. Nubra has often been indicated as a suitable field for high mountaineering, owing to its scanty rainfall. This may be relatively true, but from July 24 to September 12 rain fell almost every day at Panamik, and, since fresh snow was visible on the lower hills almost daily, the snowfall above the line of permanent snow must have been considerable. We were first told that this was unprecedented, and then that it had occurred only during the last fifteen years. But the same story was told to Moorcroft in 1821. I feel certain that the weather between mid-July and mid-September is just as bad as in the western Karakoram, and that June is the most suitable month for high mountaineering. Miss Duncan notes that in 1904 rain fell at Khapalu throughout August.

On August 4, Slingsby left me to rejoin his regiment. My debts to him during our joint expedition are quite beyond acknowledgment. I parted with Gulab Khan and Attar Khan with feelings of sincere regret. It must be the strong element of personal government which lies at the root of all military organization, which makes the Indian sepoy so very satisfactory to deal with.

I had obtained leave to cross the Karakoram pass and search in the direction of Kufelang for the lower end of the "Teram" glacier. But at Panamik I received letters both from Sir Francis Younghusband and Colonel Burrard, each independently assuring me that it must have been some upper reach of the Siachen glacier which we had found on the further side of the Saltoro pass. Appreciating the weight of advice from such sources, advice for which I can never be sufficiently grateful, I decided to attempt to prove or disprove the theory before starting on what might have been, and in the circumstances would have been, an expensive wild-goose chase.

On August 12 I was joined by Captain D. G. Oliver, British Joint Commissioner for Ladak. In 1908, in company with Arthur Neve, he had attempted to reach the Siachen glacier at the head of the Nubra valley. But they had been defeated by the size of the river. He considered that the water was too high for us at the present time, and I therefore spent a month with him in working out some problems connected with the trade-route to Yarkand, which was under his control. I hope to deal with his journey across the Kumdan glaciers to the source of the Shyok in a future number of our *Journal*.

On our return to Panamik in September, Oliver considered that the Nubra river had fallen sufficiently to enable us to reach the Siachen

glacier. Owing to the steep cliffs of granite that hem it in on either bank, and against the foot of which it sweeps at several points, the Nubra river has to be forded several times. We left on September 13 with a small pony-caravan. Tsering Spalzung, the headman of Panamik, and the most water-wise man in the valley, was our leader; Satan was the name of his most able assistant. At every doubtful point, and especially where quicksands were feared, we all awaited their verdict before trying a ford. We first crossed the river from Takshay on the east to Ayi on the west bank. The mendongs by the roadside now consist largely of waterworn slabs of white marble. A few miles above Aranu, and marking a just perceptible step in the old valley floor, we passed over the remnants of a recent moraine. It was formed around and beside the snout of the Siachen glacier during a temporary cessation of retreat opposite the Thalam-buti spur. We reached Gonpo (gom-pa—a monastery—10,900 feet) on September 14. Here there is a red-cap monastery belonging to Himis. High above the monastery to the south-west, suspended above magnificent cliffs of granite, towers a spire of perfect snow—Shelma, "The Crystal One" (Francke)—an object of veneration to these humble folk. The monks turned out to receive Oliver, and we entered camp to the impressive deep rolling boom of their drums, the long rending blare of six-foot trumpets, and the clashing of cymbals, a music perfectly harmonizing with the wild setting of the scene.

Beyond Gonpo the valley is uninhabited, though a plot of ground at Warshi is cultivated by the lamas every three years. A mile above the monastery the river sweeps into the base of the cliffs on the right bank, and it is necessary to ford across to the left bank. It was here that Oliver and Neve were stopped in 1908, but we found it only up to our girths on the morning of September 15. The Shosholing glacier tumbles down a narrow, wedge-shaped ravine to within 1 mile of the Nubra river, and we were told by the lamas that it had advanced rapidly during the last three years.

On September 16 we again forded the river, the water coming up to our saddle-flaps, and the current very strong. That afternoon we reached the foot of the Siachen glacier, camping beside a small jungle of autumn tinted willow trees and red dog-roses. I make the height of our camp, which was level with the snout of the glacier, 11,600 feet. The official Gazetteer of Ladak gives 11,700 feet for the snout of the glacier. If these two figures are accurate, they would represent an advance of the ice (since 1862) about commensurate with that which I have shown on my map.

Though this spot has certainly been reached by sportsmen, the glacier, so far as I can ascertain, has been previously visited only by Henry Strachey. In October, 1848, he ascended the glacier for two miles; he was unable to see the head of either of the two branches into which it divides about 5 miles from the snout. He remarks upon the

even level maintained by the glacier, the abrupt contact of the ice with its confining walls of granite, the unusually large amount of bare ice exposed by the moraines, and the excessive crevassation of the glacier, rendering its passage very difficult and toilsome. He concludes a description, upon which I cannot improve, with the characteristically modest remark that the understanding of glacial phenomena requires much time, study, and experience (*op. cit.*).* The survey name, Saichar, is more properly written Sia-chen (rose-place). It is said to be derived from the clumps of rose-bushes below a patch of grazing-ground on the right bank of the glacier, which have now been destroyed by advance of the ice.

We started up the glacier on September 17, taking thirteen coolies with us. We kept to the left side of the glacier, making very slow progress, as we were unable to leave the ice, and had often to cut steps up and down awkward seracs between the numerous crevasses. The first feeder on the western side might easily be passed unnoticed, for it is so smooth and is covered with such finely divided moraine stuff, that only strong glasses revealed the ice beneath. In the centre of the main glacier are numerous ice-cones, brilliantly white, and of such size and symmetry as I have only seen on the Kumdan glaciers of the upper Shyok. After about five hours we came to a deep steep-sided level-floored nala entering from the north-west. I estimated that its bed was about 400 feet below the level of the ice on which we stood.

There was a small milky stream winding along its sandy bed; it was a typical "glacial trench," but no glacier was visible in the 4 or 5 miles we could see of it. The Siachen glacier had literally overflowed or bulged into its mouth, presenting a most unusual appearance, for the floor of the glen is so level, that when facing up it we could easily imagine that we were standing on the snout of a glacier which terminated here in the usual manner. I imagine that a small catchment area, combined with the south-west aspect of its enormous granite walls, render the maintenance of a glacier impossible in this glen under present conditions, but the absence of *débris* fans showed that it had only recently been evacuated. The fact that its floor was on a level with that of the main valley shows that the huge trunk-stream of the great Siachen glacier had effected no "over-deepening" of its own bed. Owing to the chaotic jumble of seracs at this point, it was impossible to reach the valley floor for closer examination, and indeed it was some time before we found a route by which we could continue our way up the main Siachen glacier.

We eventually camped on a small grassy slope on the left bank of the glacier (13,000 feet), having come about 6 miles up the glacier in

* I have since had the privilege of discussing this expedition with Colonel Henry Strachey, whose memory, at ninety-five years of age, is happily still quite clear, and whose interest in exploration is still as keen as when he solved the problem of Mansarowar in 1846.

seven hours' actual walking. This is the best place for a first camp for any one proceeding up the glacier. Water is hard to get, but there is plenty of dead juniper for fuel. Unfortunately, Oliver had received an official message which compelled him to turn back at once, and he left early the following morning. It was very hard lines, as he had made the whole of the arrangements for this trip, and indeed, without his assistance, it is improbable that I should have been able to get any transport to follow me beyond Gonpo.

On September 18 I started on alone with Ahmadu, prepared to sleep out if necessary. The right moraines were pale grey, obviously of granite, while the left moraines consisted of black schists with slate, limestones, and various marbles. I now felt practically certain that it was the upper portion of this, the Siachen glacier, which we had reached after crossing the Saltoro pass in June. After two hours' hard walking I reached the point where the glacier makes its second great bend, sweeping down from the north-east through a steep-sided gorge about a mile in breadth, distinctly narrower than at any other part of its length. This gorge is quite invisible from below, and the idea that the Siachen glacier was bounded by a great mountain wall at this point, as shown on the Survey, on Thomson's, and on Strachey's maps, was quite a natural supposition under the circumstances.

With some difficulty I got off the glacier on to solid ground on its left bank. The ice rose 200 to 300 feet above me as I stood in the trough at its side. A steep climb of 1000 feet landed me at 12.15 on a narrow ridge (14,300 feet), from whence I had a magnificent view up the glacier. This point is about 10 miles from the snout of the Siachen glacier, and on it we erected a cairn which is visible from the glacier below. Directly on the further side of the ridge was the peculiar empty glen I have already described. Up to this point the cliffs of the left bank appeared to consist exclusively of granite; further up the glacier, but only on the left bank, I could see what I took for beds of black schist. Though I could not, of course, see the broad upper reach of the glacier on which I had camped with Neve and Slingsby three months previously, I think I can safely say that their continuity is established. It will be seen that the identical peaks on the true right bank of the glacier occur in both the last photograph taken looking down the "Teram" glacier, and in that taken from my last point of observation looking up the lower Siachen glacier.

This glacier appears to be not less than 45 miles in length, and according to Burrard and Hayden (*op. cit.*, p. 194), is the largest in the Himalaya or Karakoram systems, if not in the world, the polar and sub-polar regions excepted. Just as the Biafo glacier may be regarded as the complement of the Hispar, so may the Siachen be represented as the complement of the Baltoro. That it has escaped detection for so long is due to the difficulties of access, difficulties which must be my

excuse for the numerous imperfections of the preliminary survey which I have presented to you. Whatever the real height of Teram Kangri may be, my observations fulfil Burrard's remarkable prophecy, while Younghusband's views as to the northward extension of the Indo-Turkestan water-parting have been definitely established. H.R.H. the Duke of the Abruzzi has made the startling discovery that Conway's Broad peak attains an altitude of 27,132 feet. Also that both this peak and the four Gusherbrums are composed of marbles and conglomerates. The massif of Teram Kangri is a continuation of this range; its base appears to consist of schists and slates, and its peaks of marbles and calcites. There are indications that the same formation occurs in the Nubra-Shyok peaks; certainly the high peaks in the range south of the Depsang plains, which continues south-eastwards for an unknown distance some few miles back from the left bank of the Shyok river, consist chiefly of calcite. It would, therefore, appear that at least half of the main line of elevation of the Karakoram, the second highest range in the world, must be coincident with an axis of limestone.

NOTE.

The words "right" and "left" are always used in their strict orographical sense in this paper.

The map is based on the fixed points of the Survey of India. Much of the southern and eastern portions of it must be regarded merely as a route-sketch based directly upon the G.T.S. atlas sheets. The Bilafond-Chumik and Rgyari basins are from a plane-table sketch, on the scale of 2 miles to 1 inch. The depth and narrowness of the glacier valleys rendered the identification of the trigonometrical points a matter of great difficulty. When possible, I oriented my table by cutting in from three such points, but had frequently to fall back on secondary points or stations which I had fixed myself, and was sometimes compelled to rely on the box compass. Occasionally I made use of a prismatic compass. The sketch of the upper Siachen basin, and the position of the peaks around it depend on a base of 1000 yards measured on the level glacier. This was effected by means of carefully measured lengths of alpine rope, checked occasionally by a 50-feet steel tape. An allowance of 2 per cent. was made for sagging. The measurement is, of course, a rough one, but was made as carefully as possible under the circumstances. From the two ends of this base the peaks given in the opposite table were fixed.

A fairly good junction of the different sheets was effected at the Saltoro pass (N. 35° 23′ 30″, E. 76° 56′ 30″) and on the lower Siachen glacier. On the north-west my work, so far as it goes, is in full accord with Younghusband's. Colonel Burrard very kindly had an outline map on the scale of 4 miles to 1 inch made from my material. I have worked this up with the help of photographs, and it forms the basis of the map accompanying this paper. Sir Francis Younghusband's route on the Oprang glaciers has been re-plotted from his field-books. His route from Raskam by the Aghil pass is from published maps. Hayward's route is taken from his map in *J.R.G.S.*, vol. 40. The area thus enclosed has never been surveyed, and its delineation is therefore hypothetical. The line of peaks on the water-parting at the head of the Baltoro glacier is taken by permission from the new map by H.R.H. the Duke of the Abruzzi.

The heights of passes and camps placed in brackets in the text have been fixed from Watkin aneroid and hypsometer observations calculated from Leh Observatory.

These have been deduced by the Indian Meteorological Department by the kindness of Dr. Gilbert Walker, F.R.S. They are unusually consistent, but I found that the aneroid gave results from 350 feet to 720 feet (average, 530 feet) below those obtained by the hypsometer. This difference I have halved, and the responsibility for the actual figures given is mine. The heights of the passes, deduced only from aneroid observations, are probably too low.

Temporary sign and name.	Observed alt.	No. of rays for position.	No of rays for alt.	Lat. N. approximate.	Long E approximate
				° ′ ″	° ′ ″
L_1 Bilafond peak ...	22,200	2*	2	35 22 0	76 56 30
L_2 "Tent peak" ...	—	2*	0	27 0	57 40
L_3 "Cornice peak" ...	22,140	2	2	34 0	53 30
L_4	22,400	2	1	38 10	49 35
L_5 "Spire"	21,030	2	2	38 40	55 0
L_6 "Slate peak" ...	24,530	2	1	38 10	77 1 0
L_7	26,980	2	1	39 30	5 0
L_8 Teram Kangri ...	27,610	2*	1†	38 30	7 30
L_9	25,940	2*	2†	36 30	7 50
L_{11}	—	2	0	31 25	20 0
L_{12} "Cone"	—	2	0	28 0	15 0
L_{13} "Snow dome" ...	—	2	0	21 0	12 0
L_{14}	21,010	2	1	26 0	2 0

The rock specimens are in the museum of the Geological Survey at Calcutta, and have been very kindly identified for me by the Curator, as I have no knowledge of petrology.

APPENDIX.

Notes on the Glaciers of the Upper Shyok Valley.

Caravans travelling from Leh to the Karakoram pass have a choice of two possible routes. They may cross the Khardong pass directly behind Leh, and travelling up the valley of Upper Nubra, cross the Sasir pass into the highest reach of the Shyok valley; this is the present summer route, and along it, at great labour and expense, a pony track has been constructed by the Government of India. Or they may cross the Digar pass east of Leh, and march direct up the whole of the Upper Shyok valley; although no road has been constructed along this route, it is still used during the winter months, when the water of the Shyok river is sufficiently low to permit of its being forded without danger.

Both routes will approximately meet below the eastern foot of the Sasir pass. Here, again, there may be a choice of routes. The present road leads eastward to Murgo, and then northward by the difficult gorges of the Kizil Su to the Depsang plains and so to the Karakoram pass. But the natural route continues straight on beside the Shyok river to the small plain of Yapchan below the great Remo glaciers, where the Shyok river is left for the Chipchak or Tsaka ("salty") Chu which leads eastward over easy ground to the Karakoram pass. This last section of the Shyok valley, which would otherwise be the natural route, is now closed by the advance of the Kumdan glaciers, which, rising in the neighbourhood of peak K_{32} of the G.T.S. sheet 44A South-East, flow into the main valley at right angles to its course.

These glaciers have been named from Turki sources by Captain D. G. Oliver, the present British Joint Commissioner for Ladak, whose nomenclature is followed in these notes. The first is the Kichik (little) Aktash; the second is the Aktash

* Third rays from Saltoro pass; good for L_1 and L_2; no additional value for L_3 or L_5. † Additional ray from Saltoro pass.

(white rock), so named from an outcrop of marble near its snout; the third is the Kichik Kumdan; and the fourth the Chong (great) Kumdan.

During their minor cycles of advance, one or more of these glaciers have on different occasions thrust their snouts right across the course of the Shyok river, only to be stopped by the great cliffs on its left bank. By the making and breaking of these dams of living ice, the Shyok valley has been the scene of many disastrous inundations, the suddenness of such cataclysms entailing much loss of life in the riverine villages of Lower Nubra and Chorbat.

The great Indus floods of 1841, 1858, and 1865 have been frequently attributed to this cause; but it is now well known that the first was caused by a landslip at Gor, below Bunji, that the second originated near Hunza, and the third near Gilgit.

I believe there is no other minor problem connected with the ranges of High Asia concerning which a greater confusion of ideas has prevailed in the past, and even, I dare say, at the present time. The fact that early writers of the time of Moorcroft and Vigne invariably write of the *Shyok* river as rising in a lake which they name the *Nubra* Tso, but which they correctly place on their maps in the neighbourhood of Yapchan, has, I believe, been a stumbling-block to later writers. Again, the closing of the first or lower portion of the Shyok valley route by the normal summer flood has been confounded with the blocking of the second or Kumdan section of that route by glacier advance. This advance again, instead of being attributed to normal periodic variations, has been accounted for by the wildest theories. The glaciers have been said to have broken their backs and suddenly slid down their respective valleys into the river, no particular cause being assigned for such extraordinary behaviour. Even the rapid advance of the Upper Aktash glacier during the winter of 1902–3 is paralleled, if not exceeded, by the advance of such glaciers as the Yengutsa and Hassanabad glaciers of Hunza ('Records Geological Survey of India,' vol. 35, p. 134).

I have endeavoured to sift the historical evidence supplied by writers of last century. The chief authorities are: Elphinstone's 'Kingdom of Cabul' (see under Mir Izzet Ullah); Vigne's 'Travels in Kashmir' (vol. 2, p. 362); Cunningham's 'Ladak' (p. 154); Thomson's 'Travels in Tibet' (pp. 200, 438); Henry Strachey's 'Physical Geography of Western Tibet' (p. 55); Shaw's 'High Tartary' (p. 432); Drew's 'Jummoo and Kashmir' (p. 414); Gordon's 'Roof of the World' (chap. ii. and five illustrations); Bellew's 'Kashmir and Kashgar' (p. 161). Strachey obtained evidence of a big flood about 1780. In 1812, and probably earlier, the Kumdan route was open and remained so till about 1824, some time after which date it was closed by glacier advance. In 1835 a most disastrous flood occurred, followed by smaller ones in 1839 and 1842. In August, 1848, Thomson found the snouts of the Aktash and Kichik Kumdan extending into, and even partly across, the river, his onward path being thereby completely barred. He crossed the Aktash glacier a long way above its snout on this occasion. He either did not see or more probably did not recognize, the Chong Kumdan glacier. It is more covered by moraine than any of the others. This region appears to have been surveyed by E. C. Ryall in 1862; the Aktash glacier is marked one mile, and the Kichik Kumdan half a mile, back from the river. The Chong Kumdan is shown, and labelled as closing the road; but this is probably a later addition to the map, for W. H. Johnson returned from Ilchi by this route in 1865, and in July, 1869, on his return from Kashgaria, Shaw also followed it. The projecting snout of the Chong Kumdan glacier compelled the latter traveller to ford the Shyok, and at this point he nearly lost two of his horses in a quicksand. Lower down he found that the Kichik Kumdan had completely blocked the road, though one of his guides had passed that way only three months before. The glacier had advanced right

up to the cliffs, the river forcing its way through a tunnel in the ice. He had to abandon his baggage, and, sending his horses back to make the round by the Depsang plains and Murgo, he crossed the glacier on foot with two men. On the further side he had a narrow escape from drowning at another ford. On the third day he forced his way over the Sasir pass, reaching Upper Nubra in an exhausted condition. In October, 1873, Gordon and other members of the Kashgar Mission easily made their way round the snouts of the Kichik and Chong Kumdan glaciers. He gives pictures of both. He does not mention the Aktash glaciers, which presumably had not approached the river-bed. A short time afterwards W. H. Johnson, then Governor of Ladak, returned down this route to see if a road could be constructed along it. It was considered too expensive, but it appears that the ice was not too far advanced to render such a project by any means impossible.

Captain Oliver has supplied me with the following more recent information. Probably the last European caravan to traverse this route was that of Messrs. Church and Phelps, about 1894. About 1899 the then Joint Commissioner commenced building a road along this route; it was carried beyond the present site of the Aktash glacier, but progress was subsequently arrested by the advance of the Kichik Kumdan. Until the winter of 1902–3 traders continued to make use of the Kumdan route during the cold weather, passing round the snouts of the two Kumdan glaciers by wading or fording when necessary. In the winter of 1902–3 the Kichik Kumdan advanced rapidly, and completely blocked the route. How rapid this advance was we do not know. Oliver was told that the glacier advanced several miles during that winter. Native testimony cannot be absolutely trusted on such a subject, but it should be remembered that a similar transverse glacier in Hunza, the Hassanabad, appears to have recently advanced 6 miles in two and a half months. In 1903 a bad flood occurred, which Oliver attributes to the bursting of the Kichik Kumdan dam. There are still traces of the former existence of a lake or lakes in the broad flood-plain between the Kichik and Chong Kumdan glaciers. In 1905 the Aktash glacier advanced across the river-bed, but the river forced a passage under the ice, and no lake formed behind the dam. At the present time the route is blocked by all three glaciers.

It is probable that the explanation of such periodic glacier variations as I have described must be sought in the periodic variations of rainfall. But in attempting to correlate such variations we are met at the outset by the difficulty that hardly any two glaciers have equal feeding-grounds, aspects, lengths, or slopes of bed. Hence, by the time the effect of such a general cause reaches the snouts of different glaciers we must not expect any universal coincidence of date. In the present instance none of the glaciers under discussion have been surveyed in detail. So far as it goes, the evidence points to advance of the two larger Kumdan glaciers being by no means synchronous with that of the two smaller Aktash glaciers, and hence we can form but a rough idea of their periodicity of advance and retreat. Flood-periods occurred in 1780, 1833–1842, and 1903—that is, at intervals of between fifty and sixty years. The Kumdan route was probably open before 1800. It was closed from about 1825 until about 1860. It was again usually open between 1865 and 1902. The "open" periods seem to last for about thirty-five years, and the only complete "closed" period that we know of also lasted about thirty-five years. I have already indicated that this curious agreement with Brückner cycles must be regarded as largely a matter of accident. I have recorded the recent advance of the Saltoro glaciers, and of the great Siachen glacier of Nubra, in my previous paper.

In August, 1908, Captain Oliver visited and photographed the Kichik Aktash and the Aktash glaciers. The latter he attempted to cross, but failed owing to

want of proper appliances. When, in the following year, he met me at Panamik in Upper Nubra, he decided to repeat the attempt. We therefore crossed the Sasir pass (17,600 feet), perhaps the strangest pass in constant use. The summit glacier, some 3 miles in length, is saddle-shaped. The pommel points north; the cantle is represented by ice-fields flowing down to the pass from the south; one saddle-flap leads up to the pass from the west, or Nubra side; the right saddle-flap slopes down into the Shyok valley towards the east. We camped on August 17 at the halting-place known as Sasir, on the right bank of the Shyok. Looking up the valley, we saw the river flowing in a narrow flood-plain. Continuous steep cliffs shot straight up from its left bank, but the right side of the valley was of a much gentler slope. Snow-capped spurs swept down in great curves to a broad sloping valley-shelf, down which streamed several glaciers. Their surface was moulded into the most fantastic cones and spires, and very little moraine stuff was visible.

We started up the valley on August 18, following the old bridle path. The first glacier, a small nameless one, is soon passed. It descends to within a few hundred yards of the track, which here lies about half a mile back from the river. It lies on the top of beds of gravel and scree which cover the sloping valley-shelf, without having cut out a bed for itself or ploughed up the ground in front of it, although it is actively advancing. A glacier is not a steam-plough: it does not slide downwards as a whole; its different layers, so obvious as "bands," glide smoothly one over another. Hence in spite of more rapid melting of the upper layers, an actively advancing glacier usually presents a vertical terminal face as opposed to the receding forehead prevalent during the stationary or decadent phases.

The Kichik Aktash ends in a cliff of ice about 30 feet high just above the brink of the river-bed, so that we had to descend into the flood-plain, on to the edge of which blocks of ice are occasionally discharged. Oliver decided, from the evidence of his own photographs, that the glacier had advanced a few yards since his previous visit.

Along the edge of the river and over the dry flood-plain masses of white glacier ice had been stranded. We scrambled over outcrops of black slate towards the "White Rock," a bed of white marble which gives its name to the Aktash glacier. Just before this glacier is reached, an island of rock divides the Shyok river into two branches. The current was rapid, and the water full of blocks of ice. These greatly increase the danger of the ford between Sasir and Murgo. We found the snout of the Aktash glacier projecting into deep water; it terminated in a sheer wall of ice, round which we were quite unable to pass, and from which great blocks of ice fell into the river as we watched. Oliver said that the ice had not retreated since his previous visit. Therefore at this point the glacier is actively advancing, but the river at present is able to keep its channel clear by undercutting the ice.

The lower part of this glacier lies upon the valley shelf without cutting out a bed for itself to any appreciable extent. The ice has crossed the pony-track commenced about ten years ago. The path, showing hardly a sign of dislocation, is abruptly terminated by the steep face of ice presented by the edge of the glacier. We had no time, subsequently, to search for its point of emergence on the other side. We ascended the valley-shelf for about 2 miles. A gradually developing lateral moraine is piled beside the glacier, and soon conceals from view the rows of ice-cones which form such a feature from more distant view points. Thus seen from the moraine, the glacier appears to be embedded in a trough; but at a little distance the appearance is quite reversed, the moraines resembling high canal banks raised well above the level of the valley-shelf.

We camped about 1000 feet above the river, and at once proceeded to look for a

practicable route across the glacier. The lateral moraine here presents a steep face of hard silicious moraine-stuff towards the glacier, so that it is necessary to climb down into a deep trench, and climb up on to the glacier through steep seracs. Both operations were difficult at the time of our visit, and some of the crevasses delayed us considerably. Eventually a way was found through a great valley of ice, probably representing a closed crevasse, and in 1½ hour we reached the further bank. We had cairned our route, and the return occupied only an hour, the distance exceeding half a mile. Our camp had been pitched beside the glacier, and we reached it at 8 p.m.

On August 19 Oliver despatched Rasul Gulwan with the caravan back to Sasir camp, with orders to proceed *viâ* Murgo and across the Depsang plains to meet us at the old camping-ground of Yapchan, near the source of the Shyok river. Oliver took only twelve coolies and his Ladaki shikari, with my man Ahmedu, now a fairly expert ice-man, as cook. We did not leave camp till 1.45 p.m. In half an hour we reached the glacier. The whole party was supplied with crampons, and roped together until the difficulties were passed. We crossed in 1½ hour—good time under the circumstances. We saw that the Aktash glacier expanded somewhat at its snout, some huge masses of ice resting on the farther bank at the foot of high limestone cliffs, which weather to a warm red colour. On September 8 Oliver again crossed this glacier, and found that all our cairns had been destroyed by the normal activity of the onward flow of the ice. The Aktash glacier flows down through a fine steep-sided glen from the direction of K_{32}, but, owing to bad weather, we could not see its upper reaches. We camped at 5.15 near a small tarn beside the Kichik Kumdan glacier, and about 1½ mile from the river.

From our camp we could see the snout of the Kichik Kumdan glacier. It appeared to be quite impassable from the river-bed. On August 20 we crossed the glacier in one and a half hour. It was less difficult than the Aktash, but without crampons our coolies could hardly have crossed in safety. We saw that the snout expanded into a sort of ice-foot, this form, no doubt, being due to the force of its impact against the cliffs of the left bank. Great masses of dead glacier-ice were lying at the foot of the cliffs across the river. Between these and the living glacier the river had cut a channel. Probably this channel is not a continuous one. The middle section of the snout appeared to bridge the river, which must flow in an ice-tunnel beneath it. Where we crossed the ice, the glacier was nearly a mile broad. I estimated the greatest breadth of its expanded snout at about 2 miles. This is the identical condition described by Gordon in 1873.

After quitting the glacier we continued a short way along the valley-shelf, and then descended steep slopes of scree to the level of the river, whose broad bed here resembled a lacustrine plain. Straight ahead the lower portion of the great Kumdan glacier was visible, its last mile almost covered by moraine, though a few huge white ice-cones are thrust up through it. We struck the glacier at 2.30, at a point about 5 miles above the snout of the Kichik Kumdan glacier. The walking was tiring, but much easier than on either of the others. The glacier is nearly 2 miles broad where we crossed it (in 2½ hours). A long way up the valley we saw a high snow-peak, which I believe was K_{32} itself. We had great difficulty in getting off the glacier. A very steep slope of ice has to be negotiated, and this is constantly raked by stones falling from the moraine heaps at its edge. Steps were cut down this slope, and the coolies descended safely. Oliver waited above with a rope until the last man had got safely down. While he was descending the ice-steps an avalanche of boulders caught him, carrying him off his feet and hurling him down the slope. We thought he must be killed, but he escaped with some bad cuts and bruises. It was now 5 p.m., and the lateral glacier-torrent

which emerges from the side of the glacier about half a mile higher up presented a serious obstacle. We were in a dangerous spot, and had to ford it at once; we camped on a soft bed of fine shingle beside the main river. The snout of the Chong Kumdan projected far into the river, but owing to a sharp bend in its course we were unable to see whether any part of it reached the farther bank. If any road is made it must follow the left bank of the river, and at this corner must be blasted out of the solid rock.

On August 21 we had a very tiring march up the Shyok. Between 8.30 a.m and 4 p.m. we covered only about 4 miles, having constantly to climb up and down the cliffs of the right bank, in one place mounting more than 1000 feet, only to be forced back to the river-bed a short way further on. The rocks were of limestone and grey calcite, weathering to a beautiful red, which was very remarkable on the high peaks to the east across the river. The main valley now widens out very markedly and the river flows in several channels over a wide flood-plain. If the river were blocked this flood-plain alone would form a lake from half to a mile broad, and extending to the foot of the Remo glacier. Next day we moved our camp up to the old stage (15,700 feet), known as Yapchan (= a woody plant) Fire-blackened stones and horses' skeletons indicated considerable previous occupation. Just above Yapchan the Shyok makes a sharp turn; flowing east from the Remo glacier it bends suddenly due south. This angle is filled by a rolling, somewhat waterlogged plain, much of which is covered by tufts of grass and small woody plants, providing both fodder and fuel. Large numbers of female antelope (*Panthalops hodgsoni*), attended by a few wolves, pick up a living on these plains, and I shot a couple of the former for our coolies, who were now on rather short commons.

On the evening of August 22 Rasul Gulwan turned up with the caravan, having come round from Sasir in three days, a very remarkable performance. Rasul the Horse Thief belies his name. He has travelled with Littledale, Barrett, Phelps, and Church, and has always been spoken of very highly by his employers.

On August 23 we noticed the first signs of winter, the pools beside the Shyok being frozen at their edges. At 8.45 I rode off with Oliver to look at the Remo glacier. The ground was full of the burrows of a large ochotona which was new to me. It was about the size of a small rabbit, and had a low whistling note, much stronger than the "whisper" of *shappi*. The ordinary white-capped black redstart of Ladak (*Chimarrhornis leucocephala*) is replaced by another very similar bird, but with white patches on its wings (probably *Ruticilla erythrogaster*). Most of the hollows are impassable bogs, due to infiltration from the glaciers to the west Many are encrusted with an efflorescence of saltpetre. We passed a kidney-shaped lake, about 300 yards long, lying in a rock basin, which was most obviously *not* due to glacial erosion. Beyond it, three hours from camp, we reached a rocky knoll of limestone, and the glorious expanse of the Remo glacier was before us, a sight which Shaw described as being in itself worth a journey from Europe to see.

I have not been able to find any mention of the Remo glacier prior to Johnson's survey season of 1864, nor can I find any definite statement in the G.T.S. Reports as to who sketched its topography. The present condition of the Remo glacier is now identical with that shown in Gordon's picture of it taken in 1873 (*op. cit.*, p. 19). Rasul Gulwan was of opinion that it had advanced somewhat during the ten years which had elapsed since he had last seen it. But such advance must necessarily, owing to the great breadth of the ice-foot, be a very gradual affair. I am rather doubtful whether its delineation on the Survey map (44A south-east) can be accepted as true of the date (about 1864) which it must represent. For if it was correct the Remo glacier and the two large glaciers in the valleys to the north and

south of it must each have advanced 8 miles or more, and united to form a huge expanded ice-foot at least 2 miles wide at their point of junction; all this in the course of one decade at the outside, and during a period not signalized by active advance of the Kumdan and Aktash glaciers. It appears certain that no one has ever crossed the Remo ice-foot. Has any one actually travelled up the northernmost of the Remo valleys which is represented as originating just west of the Karakoram pass, and running west and then south for 30 miles, till it reaches the present site of the Remo ice-foot? If this valley exists as shown, there must be a very big lake in it, for the Remo dams it completely. But judging merely from what I saw later, on my way to the Karakoram pass, I cannot help thinking that a mistake has been made, and that the source of the Shyok is really the Remo glacier, and not a small rivulet visible from near the foot of the Karakoram pass. I suspect that this westward flowing rivulet eventually drains towards Shahidula, and that the northerly Remo glen is closed by a mountain wall about 15 miles from the snout of the glacier.

This huge ice-foot presents a truly magnificent sight. Although four large glaciers unite to form it, only one medial moraine is visible, which is slightly expanded at the snout. The rest of the surface is split up into beautiful cones and spires of ice, brilliantly white, and all of an even height, so that, at a distance, the glacier resembles some great white lake whose storm-tossed waves have suddenly been struck motionless. None of the snow-peaks visible up the different valleys seemed to be of remarkable altitude, though, as our station was very little above the level of the glacier, this is hardly surprising. But it is certain that such great ice-streams must derive their stores of ice from some very lofty group; it does not seem possible that they can be directly derived from Teram Kangri. These glaciers would undoubtedly afford a most interesting and profitable field for exploration, for their aggregate area must rival that of any of the four great primary glaciers of the Karakoram range.

After visiting Dalgleish's cairn just across the Karakoram pass, Oliver spent some time in trying to find a way from the Shyok valley, below Kataklik, over on to the Changchenmo. It is a very wild region of snow-clad limestone hills and deep defiles. At our farthest point we came across the remains of an old fireplace. Our Ladakis instantly referred this to Johnson, who is remembered by the natives as the most resolute of all the explorers of this desolate region.

I have to thank General Sir T. E. Gordon for kindly looking over these notes, and for giving me the opportunity of examining the sketches of the Kumdan and Remo glaciers which he made in 1873.

The PRESIDENT (before the paper): Dr. Longstaff is so well known to us all that I really think hardly anything need be said by me on this occasion. He had already done excellent mountaineering work both in the Alps, in the Caucasus, and in the Himalaya, when he made his first expedition to Asia, a political mission in Western Tibet. Perhaps the most noteworthy feat he had yet accomplished was the ascent of Mount Trisul, a mountain over 23,000 feet high. The present expedition, which he is going to describe to us to-night, deals with a little-known part of the Karakoram range. Dr. Longstaff is one of those explorers who always takes great pains before he visits a place to make himself thoroughly acquainted with all that other explorers have done, and he never makes any claim whatever to have done a thing until that claim can be absolutely established.

Lieut.-Colonel GODWIN-AUSTEN: I must first congratulate Dr. Longstaff on the excellent piece of exploring work which he did last summer. He has added a very valuable addition to the topography of the Himalayas, especially of that portion of

Kashmir territory. A very large portion of the area on the north of that part of the Kashmir was necessarily done in a very superficial way. The trigonometrical stations were very few; the assistants in the survey were expected to bring in very large areas of country mapped during the summer months, and it was impossible to sketch the mountains in anything like accurate detail. In many instances all that could be done was to map in the end of the glaciers; some of the larger ones we were able to go up, but the area brought before you to-night was some way to the east of where I was working myself in 1862. Mr. Ryall did the portion that we have had shown on the screen, and I think that his work was really more difficult than what I had to do. The upper Shayok is a most wonderful mountain system; it is unlike any other portion that I know of in the Himalayas, in the extraordinary structure and altitude of the peaks. I had, from near a peak called Shyok No. 2, which is 21,073 feet, upon the edge of the Changchenmo, a very magnificent view over all the Shyok mountains opposite, and it was one of the most wonderful scenes I think I have ever seen. My work then lay further to the east, so that I was never on the upper Shyok itself. The work that Dr. Longstaff has brought before us has cleared up the true position of that great glacier, the Saichar (Sia-chen), which was first seen by Henry Strachey, the first Englishman who went up into Ladak and began a rough survey of the country. There are many points connected with the lecture this evening, but I think there was one I will touch upon. It appears now, and from what we know of the Saltoro pass, that Vigne made two attempts to cross it; that was in 1835, when Ahmed Shah was the Raja of Skardo. At that time the Saltoro pass was evidently well known, and looking at the map now, and what Dr. Longstaff has done, it appears to me that this pass was in all probability a way by which the people of Baltistan got into Yarkund. They are particularly good mountaineers, and in their own interests they do not mind these glaciers in the least, and from the Shyok valley, where there are very populous villages, it strikes me it was one of the most feasible, probably a more feasible, route then than going by Skardo and the Braldo river, and across the Mustagh pass, the route at present used; and looking at the map and the trend of the Saichar glacier, I think it is very probable that it was really at one time in constant use. There are many other points, of course, connected with the glaciers of this region. They are vast, and a great number of them have yet to be explored. I only hope that at some early date a really scientific expedition will go up into that part of the world to examine the glaciers and their action more thoroughly, like Forbes did the Mer de Glace. There is a very vast amount of work to be done in that direction. Some of the country to the north of the Remo glacier, which you saw shown on the screen, is very doubtful topography indeed, Dr. Longstaff in his paper refers to it, and has been unable to find out who did it. My opinion is that it was done by W. H. Johnson, who at the time he went to Ilchi travelled over the great extent of intervening country very rapidly, and brought back very rough plane-table sketches indeed of the country, which were partly utilized in compiling the final maps.

Sir FRANCIS YOUNGHUSBAND: It was a source of peculiar interest to me that on my last summer in Kashmir two such fine expeditions should have come into the country to explore the northern frontier of Kashmir, in which I had myself twenty years ago been exploring. The first of those expeditions was headed by the Duke of the Abruzzi, and the second was one of which we have heard to-night—Dr. Longstaff's. They were each of them good in its own particular way, and typical of the nationalities to which they belonged. The Duke of the Abruzzi's was magnificently organised, it was soundly equipped, and it did its work thoroughly well, and achieved, I think, its main object. Although the Duke did not actually reach the summit of K$_2$, he, at any rate, attained a greater height than any other human being

has yet reached. The second expedition was what we may call a rough-and-ready pioneer expedition. Dr. Longstaff had with him Dr. Neve, a man thoroughly well known in Kashmir, and one of the most highly respected men in the country. Dr. Longstaff has one qualification to which the President has referred, that is of giving thorough credit to those who have gone before. That is a qualification which is not always met with, and it is most highly appreciated by us unfortunate men who have done our explorations early in life, and have to suffer all the rest of our lives from seeing later explorers criticizing what we ourselves have done under perhaps more trying circumstances. Dr. Longstaff's main object, I understand, was to discover this fabulous Saltoro pass, whose existence had been known for years, but whose exact whereabouts no one had hitherto been able to ascertain. Neither Colonel Godwin Austen, who was exploring in those regions before either Dr. Longstaff or myself were born, nor his collaborators had been able to exactly fix the Saltoro pass. In 1889, when I was sent by the Government of India to explore that northern frontier, and to find any practical routes there might be across it, I was asked, on my way, if I could, to ascertain where this pass was, and to find out if it was at all a practicable route. From the north side I did my best to find where this pass was, and ascended a saddle on the main watershed, but that did not prove to be the actual pass, although at the time I thought it might be. Dr. Longstaff has not only this summer found out the pass and crossed it, but has achieved three other results, of which he made very little himself, but which I think ought to be emphasized because they are of great importance. He has fixed the exact position at that particular part of what is really the greatest watershed in Asia—the watershed which divides the rivers flowing to Central Asia from those which flow down to India. Hitherto it has not been placed accurately on our maps, and it is to Dr. Longstaff's credit that he has now for the first time fixed its true position. That, I think, is one result of great geographical importance. Then, again, on the far side of the Saltoro pass, he found a glacier which he at the time naturally thought must flow north. When crossing a pass like the Saltoro, which has hitherto been supposed to be on the main watershed, and you get on the other side you naturally suppose the glacier there will flow north into Central Asia, but he discovered that it trended south, and came into the Nubra valley, and was, in fact, nothing else but the Siachen glacier. That is a second result of great importance, because it proves that the glacier on the far side of the Saltoro pass and the Siachen glacier are one and the same, and therefore the greatest glacier in Asia. But besides that, on the far side of the glacier, he saw this wonderful mountain of which he modestly puts the height at 27,000 feet. That may prove to be another discovery of the very highest geographical interest, because it is possible that he is erring on the low side; we cannot say for certain that it is merely 27,000 feet, it is quite possible it is 28,000 or 29,000. It had always been expected, as Colonel Burrard said, that there must be a large peak on the far side, and there is no reason why this peak should be not 27,000 feet, but possibly something greater. On all this, we must take into consideration Dr. Longstaff's well-known modesty, and be sure in these matters he has erred on the low side.

There is one final remark I should like to make, and that is regarding a casual observation that he made, that this peak was composed of limestone. We must think to ourselves what that really means. Limestone is a rock which must at one time have been formed beneath the surface of the ocean. You saw that enormous new mountain; you saw those other mountains of scarcely less magnitude, you must recollect that all of them are more than 1000 miles from the sea, and reflect on this, that those great mountains at that immense distance from the sea at one time have lain at the bottom of the ocean. Finally, I should like to congratulate Dr.

Longstaff most sincerely on his magnificent achievement, and to thank him for having caused us in Kashmir so very little trouble and given us such a large amount of pleasure.

Mr. Douglas Freshfield: I have no acquaintance with the region that is the subject of Dr. Longstaff's paper, but as an Himalayan traveller and an old climber I may perhaps venture to comment on some of the points raised by it. In the first place, I would congratulate Dr. Longstaff on his discovery of new peaks of over 27,500 feet, and possibly much more. If the botanist glories in a new lichen, and the entomologist in a new beetle, how much more glorious is it to add to the number of the noblest objects in creation!

No one, I think, who, like myself, has watched and shared in the progress of mountaineering for the last half-century can fail to appreciate the great advance that has been made in extending the limits attainable by human energy and endurance, and, consequently, in exploring the highest regions of the Earth's surface. It is but a few years ago that many persons, otherwise quite rational, thought it ridiculous to pretend that human beings could sleep at 20,000 feet, or climb to 24,000 feet. Now by the feats of Dr. Longstaff, the Duke of the Abruzzi, and their predecessors, Sir M. Conway, the Workmans, the Anglo-Swiss party who camped for seven weeks under K_2, the young Norsemen who climbed Kabru, and others, the "manlevel"—if I may coin a phrase—has been definitely lifted to 25,000 feet. Mountain sickness has been found to be no insuperable obstacle. We know much more about it. It has been ascertained that it is most formidable as a cumulative diminishment of energy, physical and moral, consequent on prolonged stays at high levels, as in sporting language a variety of "slackness." Consequently, the forlorn hopes which will attack the loftiest summits of our globe should, as far as possible, rush their peaks. They should have pioneers to prepare their way to their highest bivouacs. This may seem a contradiction to some of your preconceived ideas; but you will find it prove true—I speak with high medical authority behind me. There is not, in my mind, the smallest doubt that when a reasonably accessible mountain of 28,000 or 29,000 feet can be found in the British dominions, it will be climbed as soon as any one is ready to spend for the purpose a quarter of the money that has been spent on many single expeditions to get near that floating nonentity the North Pole.

Unfortunately, all the highest peaks hitherto discovered have been either excessively arduous, or are in territory barred to British explorers. Their would-be conqueror has either to evade avalanches or to get round Lord Morley, and I know not which is the more awkward obstacle. Till the Chinese Government, which, according to Dr. Stein's account, is sympathetic to research, is ready to grant passports to Tibet we must abandon all hope of Mount Everest.

In physical science Dr. Longstaff has touched on more than one question of interest. His observations tend to support the theory of the conservative, or protective, action of ice, which I ventured to maintain many years ago, in 1888, in our *Journal*. It is held to-day by several most eminent British and Swiss geologists. But it is also contested by Germans, and following the German lead by Americans. For instance, I find in our *Journal* Prof. Hobbs, of Michigan, asserting as axioms views which are, to say the least, no more than doubtful hypotheses—I refer to the supposed excavation of main valleys by glaciers and the production of cirques by snowy *névés* working backwards, to my mind a most fantastic doctrine. But this is not the place to argue on these matters. I desire simply to warn unscientific readers of our *Journal* against being unduly biassed by dogmatic and unqualified statements on moot points.

With regard to two other matters, the rate of advance of glacial snouts and the

general periodic oscillations of the glaciers, Dr. Longstaff has some new facts to bring forward which are particularly interesting to me as the English member of the International Society for the Observation of Glacial Movements. He tells us of one glacier which did 6 miles in two months and a half, which, if I have not forgotten my arithmetic, means nearly 6 yards an hour! Mark Twain was, after all, not so very unreasonable when he sat down in the middle of the Gorner glacier in the hope it would take him to Zermett in time for the *table d'hôte*! Again, Dr. Longstaff notes an apparent correspondence in the period of the greatest oscillations of advance and retreat with that observed in Europe. In the Alps the maxima and minima of the glaciers seem to be roughly 50 years apart. I saw the Bernese and Chamonix glaciers at their maximum in 1855, and in 1905 they were, as we all know, deplorably diminished. It might be interesting, did time allow, to compare in detail the physical aspect—the scenery—of the different parts of the Himalaya that have been lately opened up by travellers, and, in particular, to compare the Karakoram and the mountains of Sikhim. Such a comparison is suggested by Signor Sella's magnificent photographs, and by the fine views we have seen to-night. On the one hand, in the Karakoram, we have absolute solitudes, grim towers, and spires and obelisks of naked granite, leading in gigantic avenues 40 miles long to the hidden storehouses of the snow. The valleys are choked by the greatest glaciers outside the polar regions; the ice is hidden under hideous piles and banks of fallen rubbish; there are no trees, and few high pastures—only interminable desolation, the appalling sublimity of a region where man comes as an intruder into a dead, or unborn, world, where the only voices are the groans and creaks of the crawling ice-streams, or the thunder of the avalanche. In Sikhim, on the other hand, the traveller finds himself in an earthly paradise. Deep-cut valleys, whose sides are clothed in the luxuriance of sub-tropical ferns and forests lead up to the broad pastures of the yak, above which elegant, or majestic, snow-peaks group themselves in ever-varying combinations, while over all towers the great white throne of Kangchenjunga, a vision not to be described except by a Shelley. The landscape combines the sublime and the romantic carried to their highest powers. It is as wonderful as a poet's dream, or a child's first pantomime.

I have tried to distinguish between these two regions because, though they are some 900 miles apart, the public does not always do so—nor, I regret to have to add, does our Press assist it in the endeavour. I saw, as I came up, at a railway bookstall, in the last number of an illustrated newspaper called the *Sphere*, the splendid—and to me familiar—plate here exhibited with the superscription in large letters, "The Virgin White Peak of the Himalaya: the Duke of the Abruzzi's Record Climb." Below were the words "taken by Signor V. Sella of the Duke of the Abruzzi's expedition." It is true "this view represents Jannu in the Nepal Himalaya" was added. But how many readers will understand that this picture has nothing to do with the Duke of the Abruzzi's expedition; that it represents a peak 900 miles from the scene of his exploits, as far as Biarritz is from Vienna, and that it is an enlargement from a plate taken by S. Sella when with me in Sikhim ten years ago, and used as an illustration to my book 'Round Kangchenjunga'?

The PRESIDENT: I am sure that every one here present feels we have heard an account of an excellent bit of exploratory work. It is excellent from every point of view. It has increased our knowledge of a very wild and desolate region about which little was known before: it has, as Sir Francis Younghusband has said, solved a number of very important problems; and the author has dealt with the question of glaciation in a most interesting way. No doubt the most interesting bit of news he has given us is as to the possible existence of a mountain, Teram

Kangri, previously unknown, which may make the proud position of Mount Everest no longer tenable. He has told us in his paper how he manipulated his observations in order to make that mountain appear lower than it would otherwise appear, a proceeding probably unique in mountaineering records. The result is, that Mount Everest still occupies her royal position, though her sovereignty must remain doubtful. If I may say so, Dr. Longstaff has been very wise in the attitude he has adopted. If in the end his first calculations are proved to be accurate, and Teram Kangri is, in fact, the highest mountain in the world, he will still have the satisfaction of having his name associated with its discovery. On the other hand, he will have nothing to retract if his more modest figures are substantiated; whilst, in any case, this journey will always be remembered as a most admirable and conscientious bit of work.

Dr. Longstaff: All the gentlemen who have been so kind as to take part in the discussion have been so complimentary that there is hardly any point which calls for an answer. I should, however, like to protect myself from the incredulity of Mr. Freshfield concerning the glacier reported to have advanced at the alarming rate of several yards an hour. Following the example of Herodotus, I sheltered myself behind my authority. I referred, of course, to the Hassanabad glacier in Hunza, which I have never visited, and was quoting from the 'Records of the Geological Survey of India.'

THE GEOGRAPHICAL FACTORS THAT CONTROL THE DEVELOPMENT OF AUSTRALIA.*

By Prof. J. W. GREGORY, F.R.S.

I. The Main Factors.

In those remote times when the primæval forests that produced our coal were growing on the British area, a wide continent extended across two-thirds of the southern hemisphere. It included the highlands of Brazil on the west, the peninsula of India on the north, and probably most of Australia on the east. That vast continent, Gondwanaland, is now represented by some scattered remnants, most of which have been merged in continents of later growth; thus, its most western fragment is part of America; India has become an Asiatic peninsula; and Africa has grown northward and united with an area that is essentially European. Australia, however, although the Malay archipelago, like giant stepping-stones, links it to Southern Asia, has been left isolated in the far Southern seas.

The first fundamental factor in the geography of Australia is then its isolation. It was the last of the inhabited continents, as far as existing evidence goes, to be reached by man, and the last to be discovered and colonized from Europe. It stands apart, almost as distant as any great land-area can be, from the region that contains the chief centres of modern progress. Nevertheless, in spite of its isolation and recent occupation, Australia has already become the greatest White Man's

* Royal Geographical Society, February 7, 1910. Map, p. 744.

country in the southern hemisphere, and with the growing importance of the Pacific, its great political and strategic value to the empire is being more widely recognized.

The second fundamental geographical factor controlling Australian development is its unity of origin. Australia is all one continental fragment, and the compact shape and unique simplicity of structure due to this fact occasion the striking difference in physical and economic geography between Australia and the other continents. They all, excepting, of course, Antarctica, owe to their complex constitution, or, using a biological term, to their polygenetic origin, the existence of vast fertile internal plains, which are rendered easily accessible by long inland seas and great rivers. But though the sea, in later geological times, has twice penetrated far into Australia,* both these submergences were partial and temporary. All parts of Australia have been connected by land since very early times †; and largely owing to its long existence as an unbroken land mass, Australia has no large areas of rich agricultural land in the interior, and its farms and forests are confined to the outer zone of the continent. The last incursion of the sea into Australia was up the basin of the Murray, and it is on the plains that replaced that arm of the sea that agricultural occupation has gone farthest inland; but even there the wheatfields of the Mallee and the Riverina are only 200 or 300 miles from the coast.

The third great geographical factor in the development of Australia is the extreme contrast between the central and coastal districts. The most easily settled and most attractive districts are all on the margin of the continent. The interior is difficult of approach and forbidding in aspect, and offers to the average settler an arduous life and unluxurious home, though it has a fascination that is irresistible to those who know the spell of the free life on its open plains.

Every continent necessarily shows some climatic contrast between its interior and its coastal margin, as in Europe between Central Russia and Ireland, or in Asia between Tibet and Calcutta. But the sharpness of the contrast is usually blurred by numerous exceptions, which, though they may prove the geographical rules, confuse their statement. In Australia the contrast stands out with almost the artificial clearness of a text-book diagram.

The essential climatic conditions of a continent are five in number :—

(1) A continent should be occupied in winter by an area of high atmospheric pressure;

(2) The interior should show a marked difference in temperature between winter and summer, and

* In Cretaceous times, from the northern coast as far south as Lake Eyre; and in later times, from the southern coast for some distance inland from the Great Bight and up the Murray.

† At least since the Ordovician.

(3) Also between day and night;

(4) There should tend to be an inversion in weather changes between the interior and the oceanic margin; and

(5) The rainfall, and consequently the luxuriance of the vegetation, should diminish steadily from the margin to the centre.

Australia satisfies these requirements more simply and completely than any other continent, and each condition may be illustrated as follows:—

(1) The winter weather is controlled by the passage of high-pressure areas across the continent from west to east.

(2) The difference in variation of summer and winter temperature between the coast and the interior may be illustrated by the fact that the differences between the mean temperature of the hottest and coldest months of the year are only 8½° at Port Darwin, and 19½° at Brisbane, as examples of coastal stations, in contrast with 30° at Alice Springs, in Central Australia.

(3) The daily range in temperature in the central districts sometimes amounts to as much as 57° Fahr.*

(4) The inversion of weather change between the coast and the interior is often almost as regular as the movement of a see-saw.

(5) These four climatic factors exercise their greatest influence by control of the rainfall, which steadily diminishes from the highlands near the coast to a scanty 5 inches in part of the central plains. The other continents, owing to their more complex constitution, have areas of very high rainfall, sometimes even their highest, in the interior. Thus the largest area in Africa, with a rainfall of over 60 inches, includes the centre of the continent, and South America has a large area with a rainfall of over 80 inches in the upper basin of the Amazon. Rainfall records in Australia only go back some seventy years, but the average rainfall for a longer period is shown by the vegetation. The gum forests with their giant trees—the highest in the world, and especially valuable owing to the hardness and heaviness of their wood—are all confined to the coastal regions. Further inland, the forests are gradually replaced by scrub, and that in turn by turf-covered plains. Still further from the coast the turf is reduced to tufts of dry grass, which become sparser, until the last vegetation consists only of scattered desert plants and occasional stunted trees along the river courses.

II. The Contrast between the Interior and the Marginal Zone.

The contrast between the central plains and their mountain frame dominates all Australian geography, and explains why the economic

* For example, D. Lindsay, *Journal* of the Elder Scientific Exploring Expedition, 1891-2, 1893, p. 94.

development of the continent must proceed on very different lines from those followed in Europe or America. In Europe, for example, all the chief capitals are situated inland, whereas those of the six Australian states are all on or near the coast; and the instinct that guided the early settlers in their choice has been justified by subsequent development, for there is not yet in the whole continent a single inland city with over 50,000 inhabitants. Bourke, on the Darling, was, according to a fond prediction, to be the Chicago of Australia; but its population, according to the returns in 1905, was only 2600, and is said to be falling.

The extreme development of the central-marginal contrast in Australia is due to its compact shape and uniform structure. Australia is truly described as "the island continent," for, like typical islands, it is essentially one geographical unit; it is not, like the other continents, a collection of diverse fragments that have grown together. Its continental size, however, robs it of many of the advantages of its insular nature. Several factors tend to give Australia more uniform and homogeneous conditions than those enjoyed by any other continent. Thus, its greatest length lies east and west, and its shorter diameter lies north and south, and it is swept by wind systems, which travel from west to east and move the air in great advancing eddies, which tend to equalize the temperature between north and south. There are no great mountain ranges to disturb the progress of these colossal eddies, for the mountains of Australia are comparatively low. All the other continents have peaks two or three times as high as Australia's highest summit, Mount Kosciusko, which is even lower than those of smaller lands, such as New Zealand and New Guinea, and of small islands like Teneriffe.

Australia's limited range in latitude, its comparatively even surface and absence of high mountains, are factors tending, therefore, to give the continent a uniform temperature and climate. But these beneficial influences are opposed by an unfortunate combination of geographical drawbacks, which has given Australia its extreme difference between the interior and the coast lands. Thus the shape of the continent is unusually compact and solid. There are few great gulfs or seas running far inland, and they are either narrow, such as Spencer gulf, or are so situated, that, like the Gulf of Carpentaria, they influence only a small portion of the continent.

Another unfavourable factor is that the western coasts of Australia are washed by cold water flowing northward from the Southern ocean, so that the winds there pass from a cold sea to a warmer land. Their temperature is accordingly raised as they cross the land, and instead of their moisture being precipitated in rain, they can actually carry more. Their sudden unlift as they rise over the edge of the western plateau chills them and produces some rain; but the amount is small

compared with that which would fall if the sea off Western Australia were not cooled by a current from the south.

The west winds therefore sweep inland, withering the country with the curse of aridity instead of blessing it with plentiful rain. The eastern coast enjoys the reverse arrangement. The coasts of New South Wales and Queensland are washed by a warm current flowing southward from the tropics. The winds blow ashore over water which in winter is warmer than the adjacent land; and so they not only arrive laden with moisture, but their temperature is lowered as they reach the land. The air is therefore quickly chilled, and its moisture precipitated in abundant rains. Thus, whereas the western coast, traversed by winds that have travelled over an ocean 4500 miles wide, has a rainfall of only from 10 to 40 inches; on the other hand, at Geraldton, on the Queensland coast, the rainfall amounts to an average of 120 inches.

Again, the plateau structure of Australia injures the climate by intensifying the inequality of rainfall between the coast and the interior. Though the mountain summits in Australia are comparatively low, the mean elevation of the continent is high. Thus the railways have to begin their course inland by a steep ascent within a few miles of the sea. For instance, the two northern lines from Melbourne have to ascend, in the course of 33 and 46 miles respectively, to the height of 1145 and about 1900 feet. The western railway from Sydney, after crossing low plains for 36 miles, has to climb 3406 feet high in the next 36 miles on to the Blue Mountains. All the lines that connect the Queensland coast with the western plains are hampered by the steep ascent on to the Eastern Highlands. The winds, like the trains, have to be lifted on to the plateau as soon as they begin their journey inland. Hence, the rainfall is unusually concentrated near the coasts, and decreases with deplorable rapidity from the shore to the interior. The arid conditions reach the southern shore along the Great Australian Bight, probably owing to the coldness of the sea-water; but even there the rains are more abundant on the coast than they are inland. The uplift of the air and its consequent chilling is effected near the coast, and when the winds have once arrived inland they have practically no further considerable elevation to encounter, and there is nothing to produce further rain. Hence, no less than 938,000 square miles of the interior have a mean rainfall of less than 10 inches.

Another unfortunate influence on the distribution of the Australian rainfall is that the moistest air is carried into the interior in the summer, at the season when the land is warmest. Heavy clouds often float irritatingly across the central plains at the very time when they most want water; but as there are no mountains to uplift and chill the air its moisture is not precipitated, and it passes on to areas where rain is of less value, and may, at that season, even be injurious.

JUST PUBLISHED. *May, 1900.*

MAP OF THE

Central and Eastern Provinces of SOUTHERN NIGERIA.

COMPILED UNDER THE AUTHORITY OF

His Excellency Sir WALTER EGERTON, K.C.M.G.,
Governor and Commander-in-Chief

BY

CAPTAIN W. H. BEVERLEY,
Inspector-General, Southern Nigeria

From Surveys by Capt Woodroffe, R.E., Capt. Moir, D.S.O., R.E., Lieut King, R.E., Lieut Hearson, R.E., E. P. Cotton, Esq., and Officers of the Southern Nigeria Marine, and from Sketches by Officers of the Southern Nigeria Regiment and Political Officers in charge of the various districts

Showing first, second, and third class roads, native paths, Provincial and District Headquarters, Courts, and Resthouses, Customs, Factories, Postal and Telegraph Offices, and Mission Stations, in addition to Rivers, Mountains, Boundaries, and other physical and political details.

Two sheets—Size, 56 × 34 Scale, 7·89 miles to an inch (1 500,000).

Prices:—Coloured sheets, 20s.
Mounted to fold in case, or on rollers and varnished, 30s.

"This is by far the best general map of Southern Nigeria that has yet been produced, and until a regular survey has been undertaken it will doubtless be considered the standard map of the country. It covers nearly the same area, and is on the same scale as Captain Woodroffe's map, but is really much more than a new edition of this, since it is an entirely new compilation and drawing, prepared with great care and judgment by Captain W. H. Beverley. Altogether the map is a most creditable production."—*Geographical Journal*

London: EDWARD STANFORD,
12, 13, & 14, LONG ACRE, W.C.
Geographer to His Majesty the King.

The restriction of the heavy rains in Australia to the outer zone of the continent has produced the remarkable contrast in topographic form and scenery between the vast central plains, levelled by the winds, and the surrounding highlands dissected into a maze of mountains and valleys by the rivers. The highlands of eastern Australia have been called Cordillera in comparison with the Andes; but they have been carved out of an old plateau. These highlands were once plateaus, which have been cut up by a labyrinth of canyons and gorges by the powerful rivers maintained by the heavy rainfall. In New South Wales the rocks that formed the top of the plateau are horizontal, and in consequence remnants of the old level surface end with theatrical suddenness on the brink of lofty precipices, and the Blue Mountains west of Sydney probably afford the most perfect and beautiful representative of this type of structure and scenery in the world.

In the Victorian Highlands the rocks are steeply tilted or stand on edge, so the precipices are less vertical and relics of the original surface less extensive than in New South Wales. That the complex valleys of the Victorian Highlands have been cut in an old plateau block may, however, be recognized by inspection of the country from many commanding view points, or of such maps as that by A. O. L. Whitelaw of Woods Point.

It was the forest-clad slopes of these plateaus, the most delightful forest country that I know, which disappointed the early visitors to Australia. It was the plains between the mountains and the sea, close to land sold for agricultural purposes at £60 to £80 an acre, which Tuckey declared were useless, and would be for ever left to the kangaroos! How would he have expressed his verdict if he could have seen the treeless, turfless plains of the far interior?

III. Water Supply.

The development of the interior is, of course, controlled by the water supply, of which an ample amount is necessary owing to the warmth of the climate and the greed of Australian evaporation. I fear there is no prospect of extensive irrigation being ever possible in the interior of Australia, except on the banks of the Murray and the Darling. Elsewhere, there seems to be no hope of the large quantities of water required for irrigation. I may be reminded of the flowing wells of western Queensland, New South Wales, and the Lake Eyre district; but their yield is inadequate in amount, and their waters are usually unsuitable for continued irrigation. These wells are of incalculable benefit for stock-routes, domestic supplies, for gardens, and the cultivation of occasional patches of fodder; and they should, I think, be reserved for such purposes, as their yield in many or most localities is waning. Five years ago I objected to the arguments in support of the view that this water is being renewed from the rain more rapidly than

the wells are withdrawing it; and though my conclusions have been denied, a recent visit to Queensland has satisfied me more than ever of their truth.

The flowing wells are limited to the coastal belt, and to one wide area in the eastern half of Australia. In the western interior, the water supply depends upon the storage of rain-water, and on shallow wells, which are fortunately more prolific, more widely distributed, and more often yield fresh water than was suspected a few years ago. Instead of the rainfall in the interior of Westralia being lower than in the Lake Eyre country, it appears to be more than twice as great, averaging over 10 inches per annum; and this rain supplies shallow wells, which, when the country has fair drainage, yield fresh water. The pessimistic views once prevalent as to the well waters of the interior of Westralia were due to the first important settlements being in the Kalgoorlie district, where the waters are so salt that they can only be used after distillation. But 90 miles further north, the well waters are fresh, and though their amount is doubtless inadequate for irrigation, except for gardens, they are of priceless value for domestic and urban supplies and for the maintenance of stock routes.

The remarkable spread in the pastoral settlement of Westralia (illustrated by the Map) during the last few years has been rendered possible by the discovery of this widespread sheet of subterranean fresh water. Owing to the courtesy of the Minister for Mines of Western Australia, I was able to travel last June by motor-car to the central point of that state, excluding the northern peninsula. I passed through country that a few years ago was regarded as impracticable to anything but an organized expedition; instead of this area being a useless desert, most of it is covered with scrub and low trees, and it has abundant food for stock, and sufficient water for mining and pastoral purposes. The conditions gradually become less favourable to the east, where the climate is more arid. But even the worst of the Australian desert country, as in the area of minimum rainfall around Lake Eyre, is not always useless. For desert soil is usually exceptionally fertile, unless poisoned by some saline constituent, and after rain vegetation grows on it with astonishing rapidity. In good seasons the driest districts produce valuable pasturage. Nevertheless, owing to its geographical conditions, Central Australia is never likely to maintain a thick population, except upon its mining fields. They are, however, very widely distributed, and the newly discovered goldfield at Tanami, near the frontier between the Northern Territory and Western Australia, and that at Arltunga, show that the goldfields occur in the centre of the continent. Except in the mining fields, we can only expect the country to be sparsely occupied, and to be developed by a pastoral industry, so organized as to use the land in suitable seasons, withdrawing the stock from drought-stricken districts till rain has renewed the supply of food.

IV. Economic Resources.

The second series of geographical factors on which the development of a country depends are its economic resources, and they have divided Australian history into three stages, in which the dominant interests respectively were pastoral, mining and general commerce and manufactures. Pastoral wealth is the most easily discovered and used, and the development of Australia began with its occupation for sheep-runs. Australia was fortunate in having among its early colonists such men as Macarthur, who spared no trouble or expense in securing the very best possible breeds of sheep, and continued care has raised the wool in quality till it includes the most valuable sold on the London wool market. Drought has occasionally reduced the flocks, notably during the disastrous years of 1902–3; but sheep breed fast, and in 1907 the flocks again numbered 87,650,000 (they are now estimated at 110,000,000), and the wool exported yielded £28,861,000. New Zealand, in the same year, contributed wool to the value of an additional £7,650,000.

The vast sheep and cattle runs enabled Australasia to send London, still the wool mart of the world, 66 per cent. in value of its total supply, and to export frozen mutton of the value of £1,377,000. The total value of the pastoral produce in Australia in 1907 was nearly £35,000,000.

The pastoral industries were the first founded, because they depend so little on mechanical appliances and transport, though shearing by machinery has done much to facilitate wool production, and milking-machines may ultimately remove some existing difficulties in dairy farming. Wheat production for export followed later, and received a great stimulus from the invention of the stump jump plough and the stripping harvester. In 1907–8, in spite of the crop having been greatly reduced by the unfavourable season, the total value of the wheat crop was £9,245,000. But though wheat-farming has spread slowly inland with the extension of railways, it cannot expect permanent success in regions with less than a 10-inch, or perhaps a 14-inch rainfall, even with the special methods of agriculture devised for dry climates. Wheat production is therefore not likely to help much in the settlement of Central Australia; while vineyards, forests of hardwoods, sugar plantations, dairying, and fruit cultivation are all confined to the regions sharing the coastal rains.

Mining in Australia has been the most influential industrial pioneer. The first valuable mineral discovered was the copper ore of South Australia. Gold-mining was begun in 1851, and its goldfields have placed Australia in the front rank of mining countries. From 1851 to 1908 the gold yield of Australia has been £490,787,522; New Zealand has added £71,739,454 more, making a total for Australasia of £562,526,393. The gold yield of the United States, since mining began in 1792, has

been £632,447,387; the total yield of Canada up to 1908 is £51,546,891, and of British South Africa £237,101,786. The Australian supplies of coal and iron have been less used, but they also are enormous.

The discovery of its gold-mines gave Australia the most effective advertisement it has had. At the beginning of the year 1851, the total population was only 403,889, while ten years later it had reached 1,153,973.

The success of the mining industry led to the third stage in Australian development, the foundation of manufactures, and there again Australia has done well. In 1907, four of the six states produced manufactures worth almost £87,000,000, or £23·4 per head of the population. It is, however, in the yield of primary products that Australia has been pre-eminently successful, and its output per head of population is unrivalled. Owing to these vast stores of wealth, Australia enjoys the glorious distinction of being the one continent where the maxim "The poor ye have always with you" has so far proved practically untrue.

V. The Population.

Australia has, therefore, vast natural resources, and the use that can be made of them depends on the population. Till a century ago they lay quite neglected, as the Australian aborigines were so few in number that the continent was practically empty. The aborigines, though intelligent and amiable, are inadaptable, and, as has usually happened with nomadic races, they have died out or withdrawn upon the establishment of settled conditions.

(*a*) *The Disappearing Aborigines.*

Australia has often been charged with having deliberately killed off its aborigines, but this accusation appears to be untrue. Victoria is the state on the mainland in which the fewest aborigines are left. There was no doubt some fighting there between the aborigines and the settlers in the early days of the occupation of the country, but I have searched in vain for any evidence that the almost complete disappearance of the aborigines in that state was due even in part to their murder by the colonists. So far from the aborigines having been slain for stealing sheep, I was assured by more than one squatter that the aborigines were never grudged an occasional sheep, and only punished when they committed indiscriminate and wasteful slaughter. Aborigines were several times tried in Melbourne for sheep-stealing, and acquitted on the ground that they did not understand the nature of legal proceedings. One such verdict, in 1843, resulted in the acquittal of a black fellow accused of the theft of ninety sheep and lambs.

There were, of course, occasional murders, both of Europeans by aborigines and of aborigines by Europeans. In both cases the law did

its best to bring the criminals to justice. Three white men were tried in Melbourne in 1843, on the charge of having murdered three aboriginal women and a child at Colac. The evidence broke down, and the men were acquitted; but Judge Jeffcott told the accused that, "had they been convicted, no interest would have saved them from the gallows." McCombie, who reports the case in his 'History of the Colony of Victoria' (1858, p. 92), remarks that after this statement from the judicial bench, "no atrocities of a similar character were afterwards perpetrated by the settlers of Port Philip."

Queensland is said to have the worst record for the treatment of its aborigines. The blood feud was no doubt most severe and lasted longest in that colony, owing to the greater number and more warlike character of the aborigines and the slower settlement of the country. But even in the sixties, the period when the troubles with the aborigines were at their worst, Ling Roth, in his recent history of Port Mackay, tells us that a collector from the Berlin Museum, who spent several years on the Queensland coast, was unable to secure a specimen of an aboriginal skeleton. If aboriginal life had been held as lightly as is often stated, the collector could have readily procured a choice collection of skeletons.

(*b*) *The Growth of Population.*

Australia was practically empty when the British colonists first arrived there, and they naturally settled on the well-watered temperate country in the south-eastern quarter, and thence they have gradually spread northward and westward. The growth of population is often regarded as disappointingly slow, but it has really been unusually rapid. It may be compared, as standards of reference, with the progress of Cape Colony, Canada, and the United States.

States.	Area in square miles.	Date of first European settlement.	Population.	Date.
Cape Colony	276,995	1652	580,380 (White)	Census of 1900–1.
Canada and Newfoundland	3,750,000	1608 (Quebec)	7,184,000	Official estimate for March 31, 1909.
U.S.A.	3,622,933	1607	76,356,000 (1900)	Census of 1900.
Australia	2,974,581	1788	4,197,037 (1907)	Official estimate for 1907.
Australia and New Zealand	3,075,232	—	5,197,919	(N.Z. population in 1908).

That Australia has done well in the rate of increase of population during the last half-century is shown by comparison of the population of Australia, Canada, and the United States at different dates:—

	Australia.	U.S.A.*	Canada.†
1800	5,217	5,308,000	476,000
1820	33,543	9,655,000	840,000
1830	70,039	12,866,000	910,000
1840	190,408	17,068,000	1,690,000
1850	405,356	23,192,000	—
1900	3,765,339	76,356,000 ‡	5,371,315(1901)‡

It took Canada two and a half centuries to reach the population that Australia secured in less than one; and if we compare the rate of growth in the sixty years from 1840 to 1900, the population of the United States has been multiplied four and a half times, that of Canada three and a quarter times, and that of Australia almost twenty-fold.

The special feature of the Australian population is its high percentage of the British race. The voyage to Australia is so lengthy and expensive that it has the deterrent effect that emigrants cannot easily retrace their steps or pay short visits home. Nevertheless, of the population of Australia at the last census (1901), 95·94, or almost 96 per cent., were born either in Australasia or the United Kingdom. § Of the population of Queensland, 25·34 per cent. were born in the United Kingdom. ‖ In Canada, on the other hand, in 1901, the population of 5,371,315 included 1,649,371, *i.e.* 30·5 per cent. people of French origin, and 658,749, *i.e.* 12·3 per cent. of various other non-British races.¶ The great advantages of homogeneity have necessarily cost some retardation in the increase of the Australian population, as the source of supply is more limited.

Much stress has been laid in recent years on the decline in the Australian birth-rate, so it may be remarked that the natural increase of population is above the average. In Australia and New Zealand together the natural increase is higher than in the British Isles, and is exceeded in Europe only by Bulgaria, Holland, and Servia.

The rates quoted in the Commonwealth Year Book (No. 2, 1909, p. 168) are as follows :—

Australasia	15·38
Commonwealth	15·00
Bulgaria	18·29
Servia	16·37
Holland	15·59
German Empire	14·44

* Mulhall, M. G., 'Dictionary of Statistics,' p. 450. London: 1892.

† *Ibid.*, p. 455.

‡ The figures for 1900 for U.S.A. are taken from Whitaker's Almanack, 1909, p. 657, and that for Canada from the Canada Year Book, 1907. Second Series, 1908, p. 2.

§ 'The Commonwealth Year Book,' No. II., 1909, pp. 157–158.

‖ *Ibid.*, p. 160.

¶ 'The Canada Year Book,' 1907, pp. 2, 3. Second Series, 1908.

England and Wales	12·13
Scotland	12·09
Austria	11·33
Belgium	10·15
Ireland	5·89
France	1·42

Sir Athelstane Baines, in his Presidential Address to the Statistical Society last November—modifying Dr. Rubin's measure of progress in population (the square of the death-rate divided by the birth-rate) so as to express "humanly probable perfection" by the figure 1000—shows that the rate for the years 1891–1900 is for France 792, for England 889, and for the best European country, Norway, 908. Australia is as high as 941, and is beaten only by New Zealand, "Where a death-rate of 10 indicates the nearest approach to immortality yet on record, and imparts to a comparatively low birth-rate the borrowed lustre of 963 points." *

It is true that the rate of increase in Australia is less now than formerly, but even from 1901–1906, the years including the great drought, it was 14·9 per 1000 per annum, whereas the corresponding figure for Canada was only 13·3 per 1000, and that of the United States 16·2 per 1000. Taking the last ten years for which the census returns are available, Sir Athelstane Baines has shown in his 'Census of the Empire' † that the percentage of increase is as follows :—

	1891–1901.
Canada	11·13
New South Wales	20·92
Victoria	5·34 ‡
South Australia	13·16
Queensland	27·82
Western Australia	269·86 ‡
Tasmania	17·60
New Zealand	21·98

The Australian population increase is still above the average, though, considering the vast spaces still unoccupied, it would be all the better if it were faster.

VI. The Problem of Tropical Colonization.

The settlement of Australia has been rapid, but it is still only partial, and the policy of "Australia for the Australians" requires as

* J. A. Baines, 'The Recent Growth of Population in Western Europe: an Essay in International Comparison,' *Jour. Roy. Statistical Soc.*, vol. 72, Pt. iv. (Dec. 31, 1909), 1910.

† J. A. Baines, 'A Census of the Empire,' *Jour. Roy. Statistical Soc.*, 66, Pt. i. (March 31, 1903), 1903, p. 43.

‡ The migration from Victoria to Western Australia was largely responsible for the low increase in the former.

its complement, to use Lord Northcote's phrase, more Australians for Australia. The settled parts of south-eastern and eastern Australia have already, for agricultural districts, a fair population, as has been pointed out by so authoritative a statistician as Sir Athelstane Baines. The inclusion of the tracts that are practically unoccupied, however, renders the average for the continent deplorably low. Australia is being frequently warned that the doctrine that there are no rights of sovereignty unless supported by effective occupation may be applied to it. That doctrine was, however, promulgated to regulate the partition of Africa, and it has not been extended to any other continent. There would be no more justice in applying it to the unsettled parts of Australia than to the empty spaces of Brazil, of Northern Canada, of German South-West Africa, or of Asia, which are as empty as Australia, or even emptier. The uneven distribution of settlement in Australia is a necessary consequence of its geographical conditions. The first colonies were naturally formed in the south-eastern quarter of the continent, where the conditions most resemble those of Europe; and it was not until the settlements in the temperate regions were well established that much effort could be spared for the more difficult and novel problems in the northern regions.

The slow progress in the tropical areas is, however, sometimes explained as due to the belief that white people cannot colonize the tropics. If that theory be true, Australia must either leave all its tropical regions unoccupied, or permit the entrance of Asiatics and Polynesians. The admission of coloured races would throw away Australia's opportunity of becoming the one continent occupied by a single nation and a single race; and in consideration of the grave political and social difficulties elsewhere, due to the association of coloured and white races, that is an opportunity not to be lightly lost.

All political parties in Australia are agreed that the White Australia policy must be given a full and most patient trial. Whatever opinions may be held as to the wisdom of this policy, there is no doubt that the experiment will be tried. It is, therefore, advisable to consider the geographical evidence as to its chances of success; for of all the geographical problems connected with the future development of Australia, the most important at present is the possibility of the white colonization of the tropical areas.

The available evidence comes from three main sources—history, physiology, and experience under modern conditions. The historical evidence usually quoted is that from India, where it is claimed that a century and a half's experience has shown that white races degenerate in the tropics. It is now usually admitted that, with proper care, most white men can withstand a tropical climate; the real difficulty, it is said, is with the children. But the idea that the Indian climate is

more fatal to white than to native children, and is more deadly to white children than the British climate, is not supported by the facts. For instance, the mortality in Calcutta for white infants is 58 per 1000, while that for native infants is over 300 per 1000; and for Mohammedan children there it is 368 per 1000. In England the average infant mortality is 150 per 1000; in Burnley, the average rate for the ten years 1897–1905 was 208 per 1000, and was as much as 233 per 1000 in 1904.

The experience of India has little bearing on the possibility of white people colonizing tropical Australia; for India only proves the difficulty of maintaining the health and standards of life of a white race living among an overwhelming number of a more primitive coloured people. India, in fact, supplies an impressive warning of the evils to public health that would follow the entrance to Australia of a large coloured population.

Turning to physiological arguments that tropical climates are injurious to the white race, the difficulty with them is that they are generally so indefinite. Prof. W. A. Osborne has recently exposed the futility of some of the traditional assertions on the subject. He writes: *—

"A well known text-book on this subject, published in 1908, states that in the tropics there is a 'surexcitation of the kidneys'—which is rather vague; 'an increased activity of the liver'—which I do not understand; 'there is a deficiency in the number of the red corpuscles in consequence of the diminished proportion of oxygen in the air'—which is untrue; and 'the blood becomes more diluted' as 'evaporation from the lungs is slight'—which is sheer nonsense."

There is an increasing body of the highest expert opinion that white people can colonize the tropics, and that the ill effects of tropical climate have been greatly exaggerated in the past. Thus, Sir Patrick Manson, the leading authority on tropical diseases, tells us that "In former years, under the influence of early teaching, I shared in the pessimistic opinions then current about tropical colonization by the white races. In recent years, however, my views on this subject have undergone a complete revolution. . . . I now firmly believe in the possibility of tropical colonization by the white races. Its practicability has already been proved for many countries. I believe the time will come when it will be proved for all countries; theoretically, it is already proved, but how long we shall have to wait for the practical proof, I cannot pretend to say. Its postponement is entirely a matter depending, in the first place, on the growth of knowledge, and in the second, on the general assimilation and common-sense application of this knowledge. Knowledge in this department of science is advancing very rapidly, so rapidly that I think we cannot have many more years to wait." †

* *Argus*, Melbourne, April 10, 1909. † *Geog. Journ.*, vol. 12, 1898, pp. 599, 600.

Dr. Martin, Director of the Lister Institute, after experience gained from residence in Sydney and Melbourne, and repeated visits to India, is of the opinion that the effect of climate has been greatly exaggerated; and he tells me that it has been proved that the amount of carbonic dioxide produced by a European is precisely the same in Berlin as in tropical East Africa.

I have asked several expert physiologists to tell me what exactly is the factor in tropical climate that could render it more healthy to coloured than to white people. Apparently there is no such factor. In the extensive literature of this subject the supposed unhealthiness of the tropical climate has been attributed to heat, monotony in temperature, extreme humidity, excessive sunlight, and such a combination of heat and moisture as to occasion a high wet-bulb temperature

Heat seems at first sight the most probable factor, but it may be readily dismissed, as the hottest parts of a country are often the healthiest. Monotony of temperature is no more valid, as many tropical localities have a wide daily range in temperature, and there is no apparent connection between the healthiness of a locality and its variations in temperature. Again, moisture alone supplies no explanation of the alleged unhealthiness of the tropics; for though very damp climates may be unpleasant, they are not necessarily unhealthy, and they are, alas! not confined to the tropics.

The alleged degeneration of the Europeans in the tropics has also been attributed to the brilliant sunshine, from which the negro is protected by the pigment in his skin and the white man by his clothes. A black man would unquestionably have a great advantage in the tropics over a white man if they both worked naked; but clothing of suitable materials, opaque to the actinic rays, provides adequate protection.

The combined effect of heat and moisture requires more careful consideration, for they together may produce a condition that is fatal to human life. The researches of Dr. J. S. Haldane, Prof. Cadman, and others have shown that in still air hard work is impossible when the air is so moist and the temperature is so high that the wet-bulb thermometer registers over 78°, and that life itself may be threatened at wet-bulb temperatures of 85° and 88°. Custom may slightly raise the power of tolerating these high wet-bulb temperatures; but it is claimed that active continuous existence is impossible in an area with a wet-bulb temperature of over 85° or 88°. But this limit has no practical bearing on the problems of a White Australia, for the limit would apparently be as effective to blacks as to whites, and there is as yet no proof that any considerable tracts of Northern Australia have wet-bulb temperatures above this limit, though they probably occur on the northern coasts.*

* There appear to be no adequate wet-bulb thermometer observations available for tropical Australia. Prof. Osborne, in an interesting article on the "Problem of

It therefore appears that of the climatic factors which are said to prohibit the white colonization of the tropics, four may be dismissed as useless, and the fifth—the high wet-bulb temperature– may be non-effective, as it would be as fatal to the blacks as to the whites.

VII. The Experience of Queensland and Panama.

The problem of white acclimatization is so complex that the facts of experience are more reliable than theoretical considerations or laboratory experiments. Australia has recently supplied a most striking refutation of the impossibility or economic impracticability of white labour even under such extreme conditions as sugar-cane cultivation in a typically tropical climate. The Australian sugar industry was formerly dependent, except in New South Wales and Southern Queensland, on coloured labourers, Kanakas imported from the South Sea islands. In 1901 the Commonwealth Parliament prohibited the introduction of any more Kanakas, and ordered the return of those already in the country on the termination of their agreements. Kanakas who had made homes in Australia were allowed to remain, but all the rest were sent back in 1905–6.

The passage of this law was strenuously opposed on the ground that it meant the immediate ruin of the sugar industry. It was declared that the climate rendered it impossible for white men to work in such a Turkish-bath atmosphere as that of the sugar-fields of Mackay, and that the industry could not afford to pay white men's wages. Australia was warned by British authorities, who have written on tropical development, that white colonization of the tropics is impossible, and it was positively declared in Queensland that no Kanakas meant no sugar. I pointed out to this Society in March, 1906,* that, though most of the Kanakas had already left Australia, there was no indication of the approaching ruin of the sugar industry. The extent of sugar-cultivation in Queensland was in fact increasing; but at that date it was possible to explain the increase as the last spurt of a dying industry. Now, however, the new policy can be judged by the experience of the eight years since the anti-Kanaka Bill was passed, and of the four years since

---

Tropical Colonization" (*Argus*, Melbourne, April 10, 1909), calls attention to this gap in our knowledge, and, accepting the view that the wet-bulb temperature of 83° is the working limit, urges that means should be taken to discover any areas in Northern Australia that may exceed it. Owing to the kindness of Dr. W. N. Shaw, Mr. Lempfert has kindly supplied me with the records of wet-bulb temperature at various tropical localities. A wet-bulb temperature over 80°, and even over 86°, is not uncommon. In North Borneo, in January, the wet-bulb temperature is usually over 80°, and readings of close on 90° are "by no means uncommon." Mr. A. H. Merrin records wet-bulb temperatures up to 92° in Bendigo.

* J. W. Gregory, 'The Economic Geography and Development of Australia,' *Geog. Journ.*, vol. 28, No. 2, 1906, pp. 233, 234.

the deportation of the Kanakas was completed.* The new law has been applied so thoroughly that, whereas in 1904, 62·1 per cent. of the sugar grown in Queensland was produced by coloured labour and only 37·9 per cent. by white, the proportions are now more than reversed, and in 1908, 89·2 per cent. was produced by white labour, and 10·8 per cent. by coloured. There has been a nearly complete substitution of coloured by white labour. Nevertheless, instead of the ruin of the industry, it has increased in area, in yield, and in profit. Instead of Australia raising less than half the sugar it needs, it now raises more than it can use, and exports the surplus. The cost of sugar-cane production appears to have fallen instead of having risen, justifying the view of those who hold that white labour is actually cheaper than black, in spite of the great difference in the nominal wages.

This increase in sugar cultivation in tropical Australia is all the more striking, as there has been a decrease during the same period in many sugar-producing British colonies, including Mauritius, the Straits Settlements, Natal, Barbados, Trinidad, Tobago, and British Honduras, where there has been no interference with the coloured labour.

One especially satisfactory feature of the substitution of white for coloured labour has been that, although the Kanakas were all picked men, in the prime of life, and although they were medically inspected at the port of entry and doubtful cases were refused admittance, yet their average death-rate was higher than that of the whole white population of Queensland.

The death-rate of Queensland is unusually low, as that tropical state, according to its official statistics, is one of the healthiest in Australia. Dr. Macdonald, in a recent speech at Ingham, in northern Queensland, predicted that in time to come people will flock to the tropics to benefit by the invigorating effects of the brightness and sunshine.

Another recent practical demonstration that the tropics are not necessarily unhealthy to white people has been supplied at Panama, which was once notoriously deadly. The American Government provided the construction camps for the canal with the most careful scientific sanitation, and the results have proved that the former unhealthiness was due to curable diseases, or to remediable conditions. The reports of Colonel Gorgas, the head of the Health Department at Panama, shows that the health of the white labourers is as good, and their death-rate as low, as among those engaged in similar work in the United States. The white women and children, of whom there were eight hundred in the canal camps, had, in 1907, an even lower death-rate than in the States. There were 2674 American women and children on the Isthmus, and their death-rate was only 9·72 per

* A fuller account of this question has been given in the *Nineteenth Century* for February (No. 396, Feb. 1910, pp. 368-380).

1000. So far from the whites being less healthy than the blacks, Colonel Gorgas appears especially proud of the achievement, when the death-rate of the black labourers was reduced as low as that of the whites.

VIII. The Position of Northern Australia.

Actual experience and theoretical considerations, therefore, alike show that there is nothing in the climate of tropical Australia to prevent its colonization by white races. No doubt many eminent authorities will differ from this conclusion, and it must therefore be advanced with due deference.

Lord Northcote, whose opinion is of unique weight from his especial knowledge of the country, his Indian experience, and his generous sympathy with Australian ideals, has stated that he can express no definite verdict upon this question. Those who have not had Lord Northcote's very exceptional opportunities for judgment are bound to hesitate before coming to any conclusion. But I should be untrue to my faith in science if I hesitated to express the conviction that there is no region in the tropics which the European could not colonize, provided it be sufficiently fertile and productive to enable the colonists to live under suitable conditions, and provided that they are not swamped by a large black population.

The only doubt, in the case of tropical Australia, that seems to me serious, is whether the natural increase of the population and the immigration from Europe will be sufficient in the near future to enable Australia to spare enough settlers for the occupation of the tropical districts.

The weakest point in the Australian position is the Northern Territory, with its area of 523,620 square miles and a white population, in 1903, of 868. It is true that the southern part of the territory shares the aridity of Central Australia, but the north has a rich soil and ample rainfall, and can unquestionably grow cotton and other high-priced tropical produce, and contains mineral deposits that must some day be a source of wealth.

The development of the Northern Territory will probably be hampered by its unscientific frontiers. It is bounded to the east and west by meridians of longitude, the most unnatural of all boundary-lines. According to Mr. H. Y. L. Browne, the Government Geologist of South Australia, the Northern Territory includes large areas which will probably remain useless for a long time to come, but it has three very promising areas, viz. the northern peninsula and two large tracts of excellent pastoral country in the interior. These two tracts, however, are not well placed for development through Port Darwin; one lies along the south-eastern frontier, and its natural port is Burketown, in Western Queensland; and the other, including the Tanami goldfield, is in the south-western part of the territory, and its natural outlet is

through Wyndham, in Western Australia. If when the Federal Government takes over the Northern Territory it acquired the adjacent strips of Western Australia and Queensland, which belong to the same natural geographical division of Australia, this rectification of frontier would give the areas in the interior of the Northern Territory their most convenient outlets to the sea.

The subdivision of both Western Australia and Queensland has been often proposed, and is probably ultimately inevitable. The northern peninsula of Western Australia, the north-western corner of Queensland, and the Northern Territory would together form a great tropical territory with a convenient and natural boundary. Its Government would train a staff expert in its special tropical problems; and in twenty years' time, it would be possible to tell whether the colonization of the country by a white race is practicable within a reasonable time. If not, then coloured races might be admitted into this federal territory under restrictions that could not be enforced in any of the existing states, and the coloured people could be confined to this area owing to the desert moat that separates it from the more settled districts.

But that the Northern Territory will fail I do not believe, for it appears certain that it contains large tracts of fertile land and considerable mineral wealth. Its stock-raising capacity is undoubted, and its magnificent harbour, Port Darwin, is only six days' voyage from the great markets of Southern China, where meat will probably be increasingly used. It is, however, this very proximity to Asia that makes the empty tropical regions the chief element of danger, for the region most tempting and exposed to attack is that which Australia could least easily defend. We may, however, conclude, I think with confidence, that if the development of the Northern Territory be undertaken wisely and continued patiently, the country can be successfully colonized by white people. That, however, is not the easiest path of progress. The admission of Asiatics would cause a more rapid increase in the population and quicken agricultural development, but at the price of future difficulties and dangers.

There is an Indian saying, "No one need be lost on a straight road," and Australia has chosen the straight, but more laborious, road. It leads towards a great ideal—the development of the whole continent as one country and occupied by a people of one race. We cannot do much directly to help Australia in its progress towards its goal. Australians know better than we do how progress towards it can be most surely won. But, after children have passed the stage of direct dependence, the best gifts a parent can give them are sympathy and encouragement. We can best strengthen the bonds between us by sympathetic appreciation of Australian loyalty to our national traditions and our recognition of the high idealism that inspires so much of Australian policy.

The PRESIDENT (before the lecture): It is almost superfluous to introduce Prof. Gregory to this meeting, as he has so often lectured to us before. The first occasion on which he delivered a lecture to the Geographical Society was when he described an interesting journey to Mount Kania, a journey in which he had to overcome considerable difficulties. After that, in matters geographical, we heard of him travelling with Sir Martin Conway in Spitsbergen. Then his next lecture was one on the figure of the Earth, which gave rise to a considerable amount of discussion. The last lecture which he delivered here was entitled "Economic Geography and the Development of Australia," and the lecture he is about to deliver deals with very much the same subjects. Prof. Gregory was from 1900 to 1901 Professor of Geology and Mineralogy at the University of Melbourne, and also during part of that time he was in charge of the Geological Survey. He is, therefore, eminently entitled to speak with authority on all scientific questions connected with Australia.

The PRESIDENT (after the lecture): We are honoured to-night by the presence of the Acting High Commissioner of the Commonwealth of Australia and the Agents-General of the various colonies composing it, gentlemen who may perhaps best be described as the ambassadors representing one of those great practically independent nations which, in confederation with ourselves, we call the British Empire. Their presence here to-night will, without doubt, lead to a discussion from which we shall learn much. The interesting lecture which Prof. Gregory has just delivered proves conclusively that the forces of nature are not yet brought into subjection to the will of man in Australia to nearly the same extent as in the old world, and I cannot but feel that it augurs well for the future of that great continent that, whilst yet it is in as it were a plastic condition, so many of its high officials are evidently considering the many difficult problems before them in a scientific spirit. I must also confess that I am also glad to see them interested in geographical questions for reasons not connected with to-night's lecture. Another British expedition is about to proceed to the Antarctic continent, and I lay stress on the word "British" because the material assistance and sympathy which have been so freely given to this and to former expeditions by Australia and New Zealand make it quite inappropriate to describe them as being merely English. And I want to take this opportunity of assuring our guests that the co-operation of the southern Commonwealths is highly appreciated by this Society, for without it success would be far less probable. The growing nations of the south not only ought to but certainly do take an interest in the capture of the South Pole. We see in the papers that Commander Peary is about to undertake an expedition to the antarctic, and on this point I will only say to-night that this is a form of competition at which we rejoice. The American people, if once started, are apt to do the work in hand magnificently, and it is, therefore, especially necessary that the British Empire should not be backward in helping our gallant countrymen in their bold adventure. But we are here to-night to discuss Australian problems, which are many and complex, and I will, therefore, without further words, ask Captain Muirhead Collins if he will kindly commence the discussion.

Captain MUIRHEAD COLLINS: I am afraid I must trouble you with a very few remarks, as I have not had an opportunity till I came here of reading this very interesting lecture. The lecturer, Prof. Gregory, is well known to all of us in Australia. We attach the very greatest value to his knowledge, to his experience, and to his research, and therefore, to all Australians who are (as we all are in Australia) firmly convinced of the wisdom of the white policy of Australia, therefore I say to all of us who are Australians, his remarks and the arguments in support of that policy, and the facts which he brought forward to-night, give us not only hope, but the most cheerful optimism, to the successful issue of that

certainly very important and difficult problem which we in Australia have before us. If we successfully solve that, as we all hope we shall, we then shall afford to the world that example of a single continent—a huge continent—with one race—an ideal and an object that I am sure you all must agree is worthy of a struggle for its attainment. I hope that none of you here to-night, and I am sure I do not think Prof. Gregory intended you should, will go away with the idea that huge as Australia is, it after all is a big continent with merely a margin round it where the rainfall is sufficient to secure settlement. Australia is big enough to give away a considerable area to be unclaimed as desert, and yet have plenty left over to support a very large population, and it has been said that where the rainfall is somewhere between 14 and 18 inches, it is sufficient in our present state of knowledge, and we may hope yet to go further, to give all the advantages of settlement. Taking that rainfall and that standard (I have not the figures in my mind now), I know that we have in Australia certainly four times as much land capable even of settlement as there is, say, in a great country like France, where we see a considerable population. Also another authority has said, that even with our knowledge now and with our progress in the application of science to farming in dry countries, Australia is capable of supporting a population of quite 100 million at a high level or high standard of civilization. I think that, at any rate, will afford to us a considerable margin for a very active policy of emigration. The figures which Prof. Gregory brought before us to-night with regard to the increase of population were also equally instructive. It is significant, and it is a point often lost sight of, that, I think from somewhere about 1850 to 1900, the population in Australia increased ever so much more rapidly than it did in Canada, and now although we suffer in Australia from our remoteness, and in that respect we cannot compete with Canada, yet now that the attention of everybody in Australia is directed to the necessity of increasing our population, we shall enter undoubtedly upon a more active and more progressive policy. Also, I may say too, that as far as irrigation goes, although Prof. Gregory made some remarks with regard to perhaps the difficulties of irrigation over a certain area, I think a great many experts in irrigation are convinced that Australia offers wonderful opportunities to the irrigationist; that the contour of the country is most suitable for it; that the rivers we have provide, at any rate in certain areas, sufficient water when properly conserved to carry out large irrigation schemes. We are carrying them out in certain districts now. We have in the reservoir in New South Wales, where we are impounding the waters of the Murrumbidgee, an undertaking, I think, as big as that of the great dam of Assouan in Egypt. In agriculture knowledge increases very rapidly, and no doubt we will, as time goes on, increasingly find methods, and successful methods, by which we will more and more be able to combat the drought, and the drought, like other bogies—like the bogey of the impossibility of the white man to labour in tropical countries—will tend to disappear. Prof. Gregory's remarks with regard to that question on the people working in the sugar plantations, I think were most valuable, and those present who have not read his article in the last number of the *Nineteenth Century*, I would commend it to their attention, as in that article he brings forward some most convincing facts with regard to the sugar production in Queensland. I will not detain you any longer, as I dare say there are many others here who have a more extensive knowledge of some of these facts than I have.

Prof. L. W. Lyde: I do not think that I am in a position to speak, with so many gentlemen here who know the continent at first-hand; but there are two points I would like to draw attention to, believing all the time in a white

Australia. The first is that Prof. Gregory seemed to me to pass over the two most important results of the isolation of his continent. That isolation produced two exceedingly important political results. The first was that of all the continents on Earth, that continent alone has never been touched by war; more than that, she has never been touched even by fear of war. Consequently, all her great cities are down on the coast—put down where they ought to be, without any regard to any strategical defects of the position; and therefore from the very first they were in a position where they could command the maximum of trade and commerce. That is the fundamental geographical basis of the high *per capita* returns of Australian commerce. There was another result of that isolation. It made colonization so late in time, that when it did come it was with every possible advantage compared with Canada. It sprang into full birth at once, just as Germany more or less did forty years ago in her industrial life. The success of the wheat industry that Prof. Gregory referred to was due, in the great wheat colony of South Australia, almost entirely to the advanced scientific conditions under which the colony was settled. Then as to this matter of tropical settlement, he appeals to history and physiology, and says both are in his favour. I do not think for a moment either is. In the first place, the mere fact that children are born and survive in a climate is no proof whatever that the climate is suitable to the race to which those children belong. The vital question is, Do they survive true to type? The answer of history, under apposite conditions, is absolutely No; they do not survive true to type—Hindustan and Mesopotamia, Italy and Greece, all tell you the same thing. So do the French and the Spaniards in North America, where the French went too far north, and the Spaniards went too far south. Where a race moves to a climate fundamentally alien to them, the race invariably is modified, and in about 97 or 98 per cent. of cases it deteriorates. By all means have a white Australia, but see that the whites are white in temperament and mind as well as in colour and by birth. I do not understand what Prof. Gregory means about his physiologists asserting that there is no definite factor that you can mention. We know absolutely the physiological conditions that arrest the mental development of the negro in early youth; we know with almost equal certainty that these physiological phenomena are due to climatic control acting almost entirely through the particular food appropriate to the climate. And I feel sure that the researches of Prof. Sneddon and other sociological investigators in North America will end in proving that you can trace distinctly an increase of intellectuality in the negro in North America with change of climate from south to north, accompanying a corresponding change of food, so that the maximum of intellectuality amongst them will be found north of the line where rice and sugar cease to be natural foods. I feel perfectly certain that expert physiologists will say without any question of doubt in their own minds that no nation, white or black, can colonize a tropical monsoon climate without deteriorating. If anybody must deteriorate in that part of Australia, I say, then, let it not be the white man.

Sir JOHN TAVERNER: I promise you that I am not going to get between Prof. Lyde and Prof. Gregory, but I should like to tell you, as a layman, from my experience of the tropics, you will be surprised to know how the conditions have changed in the mode of living since the introduction of cold storage, and I am surprised that the opinion of the authorities quoted by Profs. Gregory and Lyde have not referred in any way to the great change brought about by the introduction of refrigeration.

In 1897 I had the pleasure of travelling through the sugar country in Queensland under the guidance of Sir Horace Tozer, who was then Acting-Premier of Queensland. I came to the conclusion that if we had had that soil in Victoria it would have been used for dairy farming in connection with our butter industry.

I desire to thank Prof. Gregory for the very interesting paper he has read

to-night, and, as an Australian, it is pleasing to me to know that Prof. Gregory does not forget Australia. There are persons who are now living in this country, who, although they owe their good fortune to Australia, forget that country altogether, and, in some cases, go so far as to express unkind sentiments towards her. I feel sure that I voice the sentiments of Australia in tendering our best thanks for Prof. Gregory's paper to-night. We are living in a distant part of the empire, the isolation of which has led us to adopt a policy of keeping our country for the white races. We are determined to give white labour the fullest possible opportunity in our tropical country. So far it has been clearly demonstrated that we can produce sugar with white labour. However, we can only ask the people on this side to bear with us, and give us their sympathy in helping us to carry out the policy that we conceive to be the best for our country. We venture to hope that the people on this side of the globe will remember that there is in these great overseas states room for great expansion, which is important in connection with the solving of that great problem of the Mother Country, namely, congested population. We are anxious to co-operate in every way with the Mother Country in promoting the best interests of the Empire.

Major T. B. ROBINSON: I should like to express the extreme pleasure with which I have listened to the lecture with which we have been favoured to-night. It is good to hear a man, who knows so well what Australia is, come here and in this great city tell the citizens of the Empire of the rich and wonderful land there is on the other side of the globe, and which belongs to them. It is one of the duties of the Agents-General in this country to keep on telling the people in Great Britain that these great possessions are theirs and waiting for them to occupy. I was very gratified, indeed, to hear so many good things about Australia; but the one great want we all of us realize is that of water. I am disappointed that Prof. Gregory is among those who think that the water we now get from artesian wells is likely to decrease. Most people hold the opposite view. Prof. Gregory mentioned in connection with water on the western side of that continent, that we were dependent almost entirely upon the water got from the shallow wells. Now to-day there comes a telegram from Melbourne reading as follows: "Borings carried out by the West Australian authorities on the route of the proposed trans-continental railway have resulted in water being struck at Madura, and also at a point 340 miles from Kalgoorlie. Sir John Forrest is confident of a good artesian supply which will greatly reduce the cost of the railway being struck, and add a new pastoral and agricultural area of from 20 to 30 millions of acres to Australia." I think it is extremely gratifying that this telegram should have come through at such an opportune moment, when the impression has perhaps been left upon your minds that Australia may be in places short of water. Of the great possibilities of Australia we have as yet only a most imperfect conception, and although there may be parts where water is very scarce, granted that there are inducements of another character to attract population, I feel satisfied that means will be found to give them an ample supply of water. When we remember the enormous rainfall, it seems very regrettable that means have not yet been discovered for retaining that water upon the surface, and utilizing it for irrigation and other purposes. In the wet seasons the surface of the sea at the mouths of the great rivers, and for miles outside them, is soiled and discoloured with the muddy deposits which have been brought down the rivers by the rains. I do not quite understand the disadvantages which Prof. Gregory spoke of in connection with those two large tracks of pastoral country, the one on the west and the other on the east side of the northern territory —how they are handicapped by the fact that their outlet is through another state to the sea coast. I think now that Australia has federated any such disadvantage

has almost disappeared. I should like to thank Prof. Gregory for the comforting assurance he has given us with regard to the sugar industry. A great many people were once in considerable doubt as to whether sugar could be profitably grown by white labour, and it is very gratifying to find that 90 per cent. of the sugar is now grown entirely by white labour.

Mr. Wm. Davidson: I thank you very much for the privilege of being present here to-night to hear the paper by Prof. Gregory, whom I have the honour and pleasure of knowing. We were officially associated to some extent in Australia. I am in accordance with what he said with regard to the development of Australia in almost everything, except in regard to the general application of irrigation. There are very limited supplies of water in Australia, and we are in Victoria doing the best we can with our portion of them. I think the arable land of Australia is infinitesimal compared with the whole extent of the continent, and I think it is confined entirely to the south-eastern portion of the island, that is to say, Victoria and the section of New South Wales stretching west to the River Darling. Irrigation is not so much wanted on the belt east of the Dividing range, where there is an ample rainfall and rich soil capable of assimilating it. I am very sympathetic with Prof. Gregory's optimism as regards white labour in Queensland. I do wish he would come out to Australia once again, and make a trip, not into the sugar-growing country of Queensland, but into what I think, after all, will be the great asset of Australia—the north-western portion abutting on the Indian ocean from Point Darwin to the lat. 20°, and all those great tracts of country, which would produce all the artillery horses the English army and all the armies of the world would want, if they were only bred up properly. If he would take one of his lightning visits, we would obtain from the Professor a lot of information which would be valuable to us.

The President: As the time is getting on, I think I had better bring this discussion to a close, and call on Prof. Gregory to reply; but I am sure I may, in your name, thank him sincerely for his most interesting lecture. Both your applause and the way in which you have listened to the lecture must have convinced him that we have been all exceedingly interested in what he has said. I will merely thank him sincerely for his lecture.

Prof. Gregory: I thank you, sir, and all the speakers for their kind remarks about my paper. One or two points have been slightly misunderstood. In regard to the area available for irrigation, I quite agree with Mr. Davidson that it is very small in proportion to the total area of Australia; but along the Murray and the Darling, and the rivers of the eastern coast and those of the northern territory, there are extensive areas which are extremely well adapted for irrigation, as Captain Collins has pointed out. I quite agree with Major Robinson that the real solution of Australian water difficulties is the storage of water. The amount of water which runs wasted to the sea in the winter is enormous. Australia has undertaken the construction of storage reservoirs on a larger scale than any other continent. Major Robinson asked in what respect the pastoral areas in the southern part of the northern territory would be handicapped by not having an outlet to the sea in the same state. It is quite true that since the Federation there are no interstate Customs, and the areas would get their products to the coast without any customs dues; but they would be under different administration as regards railway development, agricultural and mining regulations, education, and the many other departments still left to the State Governments. Hence there would be an artificial divide betwen these districts and their natural outlets, and I think it would be much better if they could be kept under the same local administration.

In regard to the white labour on the sugar-plantations, I may say that when

the Act was passed in 1901, I was very doubtful as to the chances of the experiment. I remember asking two distinguished Australian politicians whether they did not think it was rather a reckless step to take. The view has been expressed in this country that the policy was forced upon Queensland by the Labour Party in the Southern States; but this was not so: it was forced on the Government by the overwhelming demand of the members from Queensland itself.

I was extremely glad to hear of the discovery of artesian water in the area along the proposed trans-continental railway east of Kalgoorlie. It has been known for a long time that there is artesian water under that country, but all that has been obtained is so salt that it is of no use. It has been confidently hoped that fresh water would be found in that area, and thus remove the great difficulty in the way of the trans-continental railway. On the assumption that the newly-found water is fresh, we can congratulate Australia on this valuable discovery.* With regard to Prof. Lyde's remarks, I have been carefully into the physiological arguments, and have come to a different conclusion. His remarks show how great a change has taken place in the position of those who object to the possibility of tropical colonization by the white races. Until recently the point advanced was that no white men could work in the tropics. That position has been abandoned, and the difficulty with tropical climate is not its immediate but its ultimate effect, by injury to the type. That is much more difficult to check, because it is a prediction for the future. The evidence from the Spaniards in South America I do not think is worth much, because so many other effects than climate have contributed to their change of type. The statement that whites degenerate in India, if they live there generation after generation, was contradicted in 1873 by Sir Joseph Farrer. He refers to his examination of white people of the third generation born in Calcutta, and he tells us that "neither in physical nor mental properties was there anything to suggest marked degeneration." The opinion of such a distinguished medical authority shows that degeneration from type when people are living under suitable conditions is unnecessary. I quite agree with Prof. Lyde that if people live on unsuitable foods, they will degenerate; but food is not climate. The improvement in the negroes in the northern states of America has been due to improved conditions of life and food, and not due to climate. So many of the factors which have been claimed as causing degeneration are not climatic, and can be eliminated, and I am sure that when the white people settle in tropical Australia, they will be protected from these known causes of degeneration.

THE RIVER UAUPÉS.†

By HAMILTON RICE, B.A., M.D., F.R.G.S.

THE Uaupés or Caiary is one of the great tributaries of the Rio Negro entering that stream from the west, and is of salient interest geographically, ethnologically, and perhaps for its commercial possibilities.

In 1854 Wallace ascended the river to its Cuduairy affluent, and about this time Spruce journeyed up the stream for a short distance. Stradelli, in 1891, reached the Jurupary Caxoeira, 71° 9′ W. long., and in 1904 Koch-Grünberg ascended to El Dorado, a point ten days'

* Information since received from Australia describes this water as "stock water." so it is apparently brackish.

† Map, p. 744.

journey beyond. It was thought that the river took its origin in the Andes, having its source at no greater distance than 90 miles south of Bogota, a statement credited to Wallace and espoused by Crevaux, whose knowledge, however, was confined to descents of the Guaviare and Caqueta, contiguous rivers entering the Orinoco and Amazon respectively. Strange it is that Crevaux, who determined positions by occasional astronomical observations, and who must have known the Uaupés to be south of the Guaviare, should have reasoned thus, and stranger still that he should have mapped the Unilla as debouching into the Guaviare, when, in fact, it is the north fork of the Uaupés, and rises 30 miles farther south.

The heavily forested district limited on the north by the Guaviare, and which is the commencement of that stupendous area of the Amazonas forest, is designated here as the Vega de Caqueta, the district in which rise the Ynirida, Guainia, Issana, and Uaupés rivers. Crossing it obliquely north-east to south-west is a line of low hills extending from the Guaviare to the Ajajú, an affluent of the Apaporis branch of the Caqueta, and these are probably the hills which Wallace * refers to as situated on the north bank of the Issana in about 1° N. lat., 70° W. long., mentioned as the Serra Tunuhy. They are, however, west of the 71st meridian, and begin in 2° 6′ N. lat. On the map of Manoel Paz they are designated Sierra Tunahi, and placed on the north of a river which Paz calls Guainia (cabeceras de Rio Negro). The stream that takes its origin from these hills is known locally among Caucheros and Indians as Caño Grande, and much mystification and conjecture exist as to its real identity—whether the Ynirida, which is probable, or the Guiania, or the Issana, a most unlikely possibility. Innumerable caños course across the vega, and all of these are gathered in by Caño Grande, which early asserts itself as a stream of importance.

To the west of these hills the country intervening between them and the Andes is a trackless wilderness of dense forest and swamp, enclosed by the Guaviare and Caqueta systems, whose headwaters, rising in the Andes just to the east of Jigante, might be said to intercommunicate, so close is their juxtaposition. To reach this country from Bogota, a line of march east across the Andes was pursued by me, beginning July 26, 1907, to Villavicencio, thence south over the llanos to San Martin, a cattle centre and last outpost of Colombian municipal control. This ordinarily can be accomplished in a week or less, depending upon the season. Heavy rains, however, with resultant swollen streams so complicated and retarded the progress that sixteen days' time was consumed. Here several weeks' more delay had to be patiently endured, and periods of fever were alternated with disputatious conferences, in which all the town partook, as to whether Rio

* 'Travels on the Amazon and Rio Negro,' p. 417. By A. R. Wallace. London, 1853.

Unilla debouched into Rio Guayabero. An old map of Codazzi, which adorned a wall of my adobe residence, was an inspiration for every quidnunc to illustrate his particular views, further enhanced by the suborning of whatever poor ignorant Indians happened to be in town. Geographical enthusiasm, however, gave way to financial computations of what it would cost to descend the Ariare to the Guaviare, and then transport the cargo southward across the densely forested country to the upper affluents of the Uaupés. San Martin had "cornered the exploration market," and the values of men and supplies soared accordingly. Eventually, however, a compromise was effected, though at a ridiculously high price.

From San Martin it is two short days' march to Iraca, a house on the Caño Caimeto, a small affluent of the Ariare, and used as a port of embarcation. The Savanna country of San Martin gives way to one of elevations and depressions, known locally as sarraniá, whose trough-like vales were filled with dense growths of mauriche and cumari palms. This stretch forms the watershed between the Meta and Guaviare systems, trending along the Ariari, which rises in the Paramo de Suma Paz near Fusagasugá, southward, till it debouches into the Guayabero, or Guaviare as it becomes known below the junction. Four days were spent descending the river leisurely, which flows in big meanders, sometimes through densely forested areas, at others swinging by land more elevated and open. As it approaches the Guaviare, islands become numerous, as well as alligators of gigantic proportions, though of less pugnacious disposition than their combative *confrères* which menaced Crevaux in his descent of the latter stream. The voyage was uneventful, barring the attempt of a large macarel, a serpent of the rattlesnake family, to force the fighting by boarding the canoe, once his anger was aroused by a heavy blow of a paddle for his temerity in mid-river in crossing our bows. The rencontre was unpleasant till the temporarily inaccessible guns and cutlasses could be obtained. The Ariare has no tributaries of any size, and its densely fringed banks give way to open savanna, usually less than half a mile from its shores. The rubber trees of commercial value are the *Caucha negra* and *Caucha rosalis*, though not seen here in any unusual abundance.

A prominent hill south-west, the beginning of the range before mentioned, marks the near approach to the confluence of the Guaviare and Ariare, which was reached in the early evening of September 17, and just below the junction on the right bank is the barraca * of Carlos Borrero, brother of two men of my party, who, signalled by our gobono (ox-horn) blasts, stood waiting to receive us and offer advice on the landing, rendered doubly difficult by a swift current and steep river margin.

Near Puerto Alturo a zambo and myself, disembarking some distance

* Shed or shack

down the river early in the morning, intending to procure monkeys for breakfast, got separated from each other, spending a miserable day floundering helplessly about in a big laguna, from which we were unable to extricate ourselves. Heavy thunderstorms were succeeded by night, further complicated by our stumbling upon a small herd of peccaries—unpleasant opponents to meet when ammunition, mental energy, and physical strength are alike exhausted. The in-and-in fighting ability of these animals I have witnessed on numerous occasions, when they, with jaws shot away, legs broken, and bodies fearfully mutilated, have badly punished big hounds. A providentially fallen tree-trunk saved us from an ignominious end, allowing later an inglorious return to camp, and the slaughter of three of our valorous foes.

From Puerto Alturo to Santa Maria, after a couple of hours, a natural clearing is reached, which allows a view of the low-lying sierras that appear from a distance as an even tree-covered elevation of mesa or scarp formation; but a close approach reveals a very different condition, for they are seen to be distinct domes separated by deep impenetrable ravines, gloomy chasms, huge fissures and beetling cliffs, while an impenetrable jungle of carob, palm, and scrub contributes to the eeriness and desolation. The trail winds through gorges, canyons, and tunnels formed by massive blocks of rock, superimposed upon others, whose igneous character gives evidence of some past cataclysm. Where bog and sand have been scoured away, the corrugated scoriaceous quality is everywhere indicative of the previous molten condition, and over such a bed the Lindosa, a shallow but broad stream, courses to empty into a laguna of the Guaviare.

When Caño Grande is reached, bullocks are dispensed with and the men become *cargueros*. The packs are divided into small lots, which enable them to be compactly placed in a cradle or saddle constructed from two stems of the tough *mil-peso* palm, whose leaves are so plaited as to form a framework 3½ feet high, 1 foot broad, 9 inches to 1 foot deep, in which cargo may be most expeditiously carried through thick woodlands. When material is obtainable, such as sacking made from pita, it is whipped to light strong sticks and used by preference. These are carried upon the back by means of forehead and shoulder bands, for which the tough bark of the bornu is utilized. Extraordinary feats of strength and endurance are enacted, 6 to 8 arrobas (150-200 lbs.) being carried for long distances over the roughest kind of trails and single slippery narrow log-bridges, where a misstep means grave or fatal consequences. They work on the most meagre diet, principally coarse hulled maize, which is boiled, seasoned, when fortunate, by brown sugar, *carne seca*, or tapir.

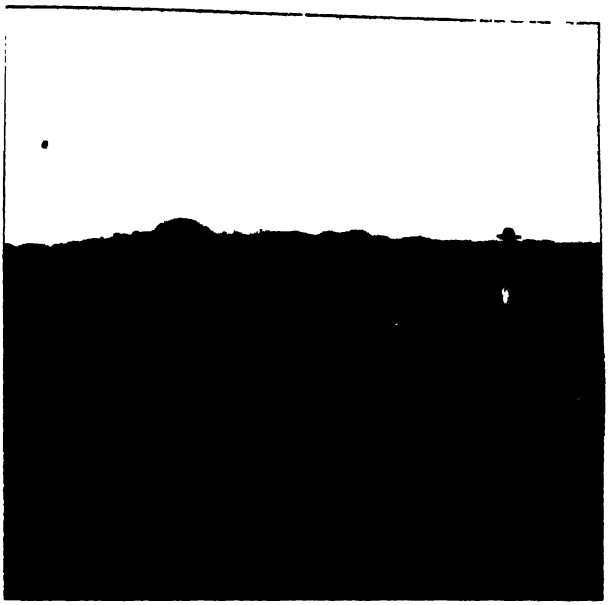
Calamar is on the left bank of the Unilla, where a small clearing has been effected, and a path leads south two days distant to the Itilla river. Here I remained three weeks taking observations, and gleaning

every sort of information from Indians and caucheros. The Unilla here *is 25 yards wide, and varies in depth from a few inches to 3 fathoms, according to the season. Just above Calamar the river forks into two unnavigable streams, whose individuality becomes lost in capillary-like* rivulets.

On October 28, with two men and packs reduced to rifle, sextant, hammocks, and sparsest rations compatible with circumstances, a march across the vega toward La Sal was begun, where a great laguna was said to exist, which I imagined might be the one depicted on Paz's map in connection with the Guainia, but it proved to belong to the Guaviare. The route was east of the one taken when working south, and worse in every way. Caño Grande when reached was 22 yards wide, 2½ fathoms deep, with a rushing torrent over which it was necessary to construct a bridge. On either bank were caucheros bivouacked preparatory to mobilizing in La Sal, and these, working in conjunction, felled opposing trees to lock in mid-stream. Held, however, by intervening limbs of others, it required some daring work of cat-like agility before the trees fell clear. Chonta palms were stepped as buttresses, others lashed as railing with yary, a vine of the size and consistency of telegraph-wire, which trails from the trees in a profuse fashion, and in three hours a bridge was open to traffic. From here to La Sal is a good tapir country, and each camp had its *pacera* (raised framework of crossed poles), upon which meat was being cured by roasting and smoking.

Just before La Sal is reached the trail strikes across a swampy savanna, a path due west leading to San José, where an abandoned maloca exists a mile or so back from the river, upon a plain of lava formation covered with coarse grass and chaparal. La Sal is made up of sheds and kitchens, a despatching and distributing point for rubber of the *Calderon impresa*, and presents a busy scene when the Indians and caucheros are in with several months' gathering of rubber. From here an ascent was made, two days, to Puerta Alturo, the night being passed at San José. Our smoke from the maloca awakened the curiosity or resentment of some Guahiba Indians, for two naked specimens appeared from apparently nowhere, though they were appeased by assurances that we were moving on the morrow, and some gifts of sugar, salt, matches, tobacco, and a drink of aguardiente. Within the maloca freshly overturned earth showed two recent interments, an Indian reason for its abandonment. Toward nightfall many dusky forms could be seen squirming through the long grass, but some carbine-shots sent them scattering and scampering into the timbered recesses of the neighbouring laguna.

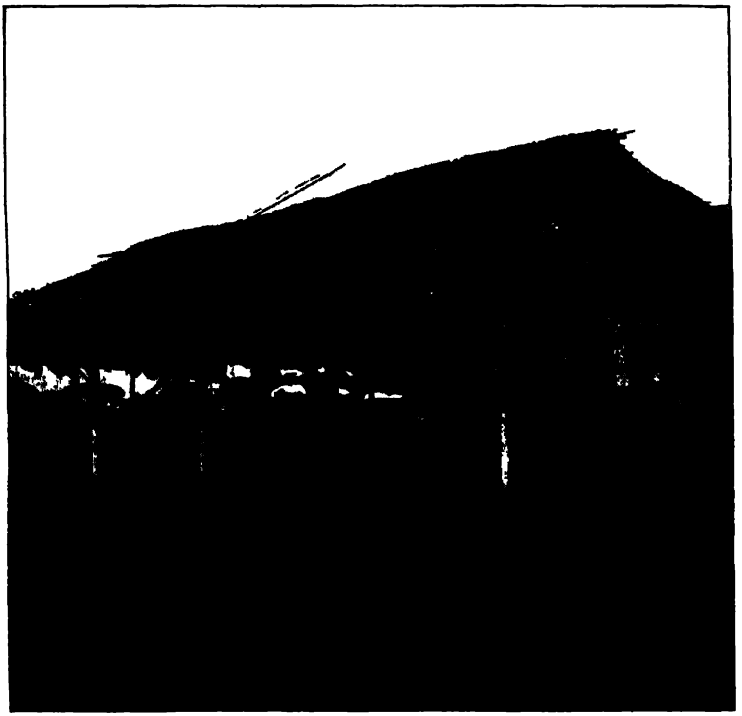
From Puerto Alturo a return march was made to the west of the first track followed, crossing the caños in most cases at their very inception. At Calamar a tall pole was erected, surmounted with a flag. Close to the Earth's surface the mornings were usually very calm, while



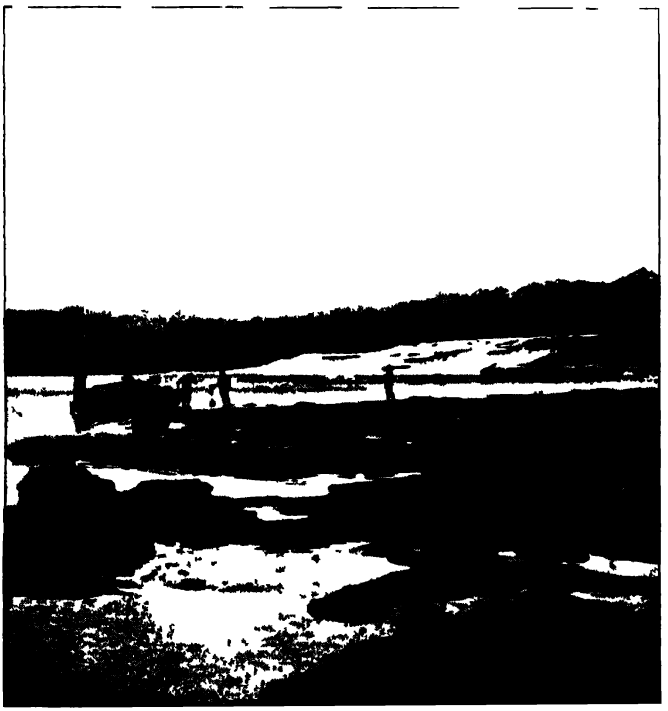
TRANSPORTING THE CARGO TO THE RIO ARIARE ON THE LLANOS OF SAN MARTIN, IN THE RUVIANO COUNTRY.



PUERTO ALTURO, RIO GUAVIARE AT MOUTH OF RIO ARIARE. BARRACA OF DON CARLOS BORERO.



HOUSE OF A "RACIONALE," OR TRADER, CARLOS TOVAR, UPPER UAUPÉS.



higher a gentle air-current drifted cumulus clouds eastward. By noon or a little after cumulo-nimbus were returned from the east, which later seemed ricochetted by a westerly or west-north-westerly breeze, generally culminating in heavy thunderstorms. The barometer was invariably highest at the first or morning reading, and lowest at the afternoon (4 p.m.) reading. Temperature was less constant in its diurnal variation. The highest temperature recorded was 98°·5, lowest 74°·5, average 87°. Barometric and thermometric readings were taken daily at 8 a.m., noon, and 4 p.m. Throughout this region, winter or wet season is of nine months' duration, and summer or dry, three months, viz. December, January, and February.

The animal-life of the Uaupés is abundant, as attested by large jaguars, striped tiger-cats, tapirs, peccaries, deer, monkeys, sloths, boas, poisonous serpents, agoutis, big otters, and turtles. Two varieties of the peccary are found, the saina or manáo, and the cerillo or cajuchi. The hair of the former is longer, coarser, the teeth shorter, darker, and the fore feet characterized by dew claws externally and internally placed, the hind feet showing them internally; while the cajuchi has but a single one on the fore feet, and absent on the hind. They hunt in herds, and when excited clack their jaws, simulating castanets. Birds are represented by macaws, parrots, toucans, egrets, several varieties of the currasow family, gaivote or small gull, and a number of brilliantly plumaged birds for whose Spanish or Indian names I have no equivalent. Of fish there are countless varieties, the chief of which are the small delicious jacú; the dreaded caribé; the long and thin guaracu; the bágarre, white bellied, with dorsal markings of dull blue; the barbudo of big yellow belly, dorsally black streaked, and exopthalmic-like eyes; the pintadillo, harlequin marked and larger than a salmon; and the pirahiba. As far up as the Ipanoré, the first fall, the manatee is found, but higher he does not go. The temperature of the Uaupés 3 to 6 feet below surface was invariably 76° Fahr.

On December 9 the descent of the river from Calamar was commenced in a monteria type of canoe, with a crew of eight Cubbeo Indians, in company with José Espriella, a young man of great natural intelligence, whose mother is of much importance in the Carijona nation, his consort a Huitote, he himself master of several Indian dialects, and to whom I was indebted for much information and kindness. The stream was extremely tortuous, less than 2 yards wide in places, and occasionally progress was completely blocked by floating logs and *débris*, it being necessary at times, when the combined weight of the disembarked rowers failed to sufficiently submerge the jam, to break it with cutlasses and axes. On the second day the narrow lanes began to open up somewhat, but the stream still continued a course of sharp winds, twists, and turns. By noon of the fourth day the junction of the Unilla and Itilla was reached. The mouth of the first measured 33 yards, depth

4½ fathoms; the second had a width of 47 yards, depth 6½ fathoms. The Uaupés just below the junction was 74 yards wide and 7 fathoms deep. All measurements were made by tachymetry, and soundings with ship's lead and line. The fall from Calamar to the junction of the two affluents, as given by Kew-tested Watkin mountain aneroid, is 77·5 feet. The current is stronger in the Itilla, suggestive of its origin at greater elevation than the Unilla, compared with which it is a larger, longer stream, and should be considered the main upper tributary of the Uaupés. Both affluents are white water. Itilla and Unilla are degenerated forms of the Carijona words Itiya and Uniya, signifying respectively *paujil*, a bird of the curassow group, and *gusano*, a worm. The Itilla enters the Uaupés flowing south 120° east, and we ascended a short distance to where Espriella has a house on the right bank at an elevation of 100 feet from the river, and whence, looking west, hills of a scarp character similar to those of Tunahi can be made out, and are a continuation of that series. According to the Indians, it is possible to go up-stream ten days, the last two or three of which it is very tortuous, and that then the river emerges from a laguna. As neither craft nor men were available, I was compelled to forego my plan for ascending this southern tributary, and to continue down to the Jurupary caxoeira (falls or rapids) with Espriella, where he intended working the *Caucha xeringue*, or white rubber, which is not found on the upper Uaupés.

From the junction to the Jurupary is a two weeks' journey. The river is white water, the current sluggish, the course exceedingly crooked. There are not the signs of playa formation such as one sees in the Guaviare and rivers of greater velocity of current, the banks being steep, and the depth of the river near shore equalling that of the stream's centre; its corrosion shows as much work exerted against its boundaries as upon its bed, as is displayed by the enormous broadening in places, taking on the nature of a lake, and the elaborately developed lagunas which flank its sides. A day's journey below the junction an affluent, the Jerisa (white water), comes in on the right. It is a stream of no great size, hemmed in as it is between the Itilla and the Macaya branch of the Ajajú. For the most part the Uaupés is a desolate wilderness to the Jurupary, and to this point flows through an apparently level country, whose flood-plain consists of a white unctuous clay, while the land elevated above it has a sandy soil, in some places so loose as to be ankle-deep and more.

When the Jurupary caxoeira is reached, the river rushes over rock of vesicular and scoriaceous texture, the denuded core apparently of a massif of laccolithic structure running north-north-east to south-south-west from above the Issana on the north to below the Apaporis on the south. Just above the Jurupary are the Pucaron rapids, and from here until the Uaupés empties into the Negro are thirty caxoeiras, as the

cataracts and falls are called, and sixty correntadas, or smaller rapids. Difference of level from above the Pucaron to below the Jurupary the aneroid barometer gave as 93 feet. From here to the Negro the evenness of the country is broken by isolated hills of igneous rock, of dome and cone formation, and these, as a rule, are tell-tales of existent caxoeiras, or so worn down as to be exposed only at low water. Below the Jurupary rock is granitic for the most part, streaked with quartz. At some of the caxoeiras are huge boulders, immense slabs, and enormous fragmental masses superimposed upon each other, while again fusion and crystallization appear to have been synchronous. In some cases, as the Jurupary and Tatú (armadillo) caxoeiras, the river plunges over scarp-like formations, but oftener rushes down through gorges with dizzy swiftness, its volume broken and churned into engulfing waves, whirlpools, maelstroms, eddies, bubbles, and foam by the rough, uneven bed. Most of these the natives shoot, the pilot always a man of nerve, strength, and keen vision, but above all of consummate skill. When *tuxauas*, or chiefs, honoured me with their company they were in several instances old men, and the masterful and extraordinary way in which they navigated the long, narrow, rolling, and too often overloaded *ubás* through these hazardous courses, when the slightest error of judgment or physical laxity meant destruction, was such as to excite keenest admiration for their canoemanship. I well remember a solitary individual on the rock-terraced wall of the Macucú (fruit) caxoeira, whose coarse black hair, narrow-slitted and Pierrot slanted eyes and brows, colour, and features belied his pretensions to Lusitanian claim; when my Indians had just negotiated in most precarious fashion the twisting Nana (pineapple) above, and refused to attempt the Macucú, he treated them with contumely, ran in turn, single-handed, the two canoes in the most masterful and *sangfroid* manner imaginable.

Much conglomerate of a pumiceous and scoriaceous character, cemented with clay, is found below the Jurupary; and still further down-river, granite and quartz conglomerates, and all vary from extreme hardness to friable and crumbling rottenness. The apparent levelness of the country is deceptive, for in traversing the terrain it is seen to be a surface of undulating and crumpled unevenness, significant of a process of uplift having ensued in conjunction with, or as complementary to, the violent volcanic activity of a former period, both being factors in bringing about its present constructive topographical character.

The Uaupés in its upper portion is white water, but lower down, in the granitic district, it becomes black water, as are its tributaries—the Kerary, which comes in from the north, and the Papory on the south. From the Jurupary district down are found the most highly prized rubber trees, from which the *Caucha xeringue* is obtained; and a variety of palm called corejia, a long slender trunk with spraying top, becomes very common here, but is not found above.

The Carijona nation occupies the territory of the Macaya and Ajajú rivers, and some members of this tribe wander over into Uaupés territory, and are the link between the Huitote nation and the Uaupés tribes. The Huitote women are much sought after as consorts by the caucheros, who bring them to the upper Uaupés. On the Caqueta are two tribes much dreaded on account of their hostile and uncompromising attitude toward any conciliatory advances from others, and they enjoy a great reputation for fierceness and bravery. These are known as the Andoques, the so-called white Indians, on account of their reputed light hue, who inhabit the territory known as "Choreda araquara," situated on the right bank of the Caqueta between the Cara-parana and Rio Chorida. The other is the Miranha tribe, whom Chandless * digressively mentioned in his model brochure of the Purus. It may be that the Auhishiras so dreaded by the Piojes and Orejones of the Rio Napo are marauding nomad Andoques or Miranhas. On the Uaupés the Cubbeos occupy the territory from Carurú igarape to below the Jurupary, the Guainanos from above the Tatu caxoeira to the Panapaná, the Tarianos from here to below the mouth of the Papory, below which are found the Tucanos. The Cubbeos seem to be a smaller people physically than the others, short, slender, and lithe; some of the largest men I saw were up the Cuduairy, where specimens upward of 6 feet with big necks, square shoulders, thick arms, and powerful torsos were found. The abdominal protuberance so marked in both adult and young is due probably to the coarse, bulky, innutritious food and enormous consumption of fermented drinks upon which they subsist, rather than to any peculiar physical idiosyncrasy. Their colour is an olive brown, corresponding to #4 of Broca's scale, and seems invariable—a conclusion based on a comparison of the scale with many hundreds of subjects on parts of the cuticle least exposed to sun and pigmented decoration. The eye is dark, the palpebral fissure narrow, not oblique, pointed at its external aspect, and the upper lid so heavy at times as to suggest the puffiness of œdema; but the eye by no means conforms invariably to so Mongolian a criterion, closely resembling the European eye in many other cases. The hair is black, lanky, coarse in the male, fine and glossy in the female. The faces are escutcheon-shaped and hairless, chins rounded and receding, noses from straight and *busqué* to hooked and Chinese flat types, region of cheek-bones flat, lower lips large and inclined to turn slightly downward. The ears are not large, lobes absent or slightly developed; heads of the brachycephalic type, though I have noticed cases of extreme dolichocephalic variation. Teeth are generally poor.

They are capable of great and prolonged exertion on the smallest possible amounts of food and sleep, slumbering even in the open entirely naked, exposed to wind, rain, and lowered temperature, awaking usually

* *Proceedings* of the R.G.S., vol. 36, 1866, p. 86.

when the vitality of the various bodily functions have reached its lowest ebb at 4 a.m., then huddle chattering and shivering around a fire until the natural warmth of the body temperature is restored. They are amphibious, bathing many times a day, and all are good swimmers, doing the erroneously termed Australian crawl stroke as naturally as they walk, which seems characteristic of the aborigines of all the lesser-known districts of the world. Their canoemanship stands foremost and perhaps unequalled, judging from an experience of many river journeys in the wildernesses of both North and South America. Trained from earliest youth with a Spartan mode of procedure, they are made to run most dangerous rapids in tiny ubás, taught in a dramatically practical way the rudiments and science of a craft in which they attain a proficiency when ten or even younger that no white man could hope to achieve during a lifetime. It is the result of training and experience of countless generations in which environment and heredity are predisposing and influential factors.

The canoes or dugouts, known as ubás, are made from tree-trunks such as the cachicama, gouged out by burning, with considerable sheer imparted stem and stern, which gives a rise from amidships to either extremity, but lacking the square blocked-out overhang aft which characterizes the craft of the Napo river people. The paddles are circular blades sometimes as much as 16 inches across, with ogee-shaped throats, long, straight, smooth round looms, and cleverly fashioned handles, the width of the palm affording the handle hand firm finger grasp. These are hewn out of a single piece of wood with a machete in from twenty-five to thirty minutes. Their ubás vary from 5 to 50 feet in length. Notwithstanding the Draconian rigour of upbringing, fathers are affectionately attached to their male offspring, and generally insisted upon bringing their hopefuls along, who, however, worked hard and copied the elders in a ludicrously precocious and serious way. The men always parted from the wives in a very reluctant and unwilling fashion, and only because the mandate of the tuchána or chief compelled obedience according to maloca polity; they disliking intensely at having to leave their households even for a day, and the exasperating and treacherous desertion, fraught always with embarrassing conditions and grave possibilities to the abandoned explorer, followed several times in consequence of this non-nomadic and nostalgic idiosyncrasy, afforded a bad precedent to the youths, who emulate in every way the practices of their elders.

Wallace speaks of the Cubbeos as cannibals* who eat their dead enemies, and make war for the purpose of obtaining human flesh, but evidences of anthropophagic tendencies are by no means confirmed. The old slave-raiding days, when Portuguese and Indians ascended from

* 'Travels on the Amazon and Rio Negro,' p. 498. By A. R. Wallace. London: 1853.

the Rio Negro and spread terror and havoc among the Uaupés tribes, killing their men, burning their houses, and impressing the women and children as slaves, are still doubtless remembered, and counter acts of violence and murder do occur as a resultant perhaps of the outrages of those man-hunt days.

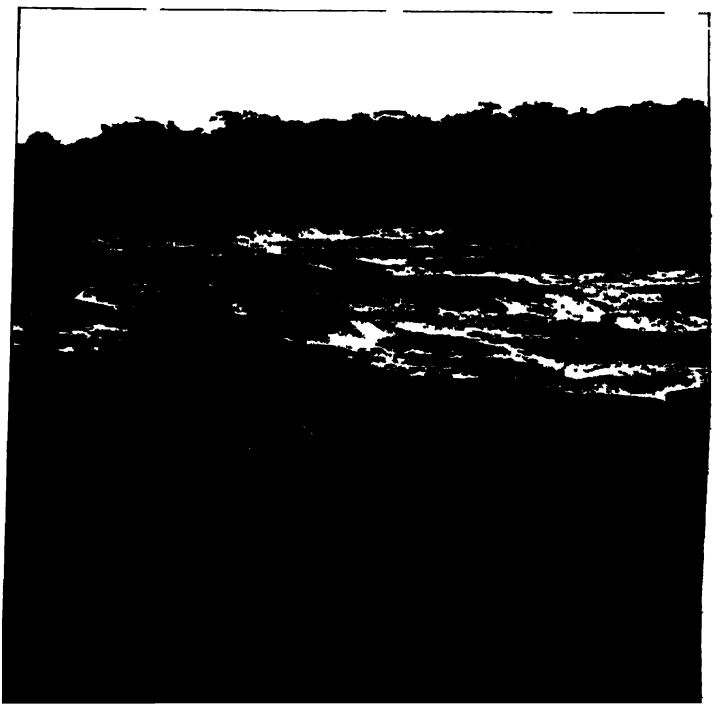
Three years ago, four Colombian caucheros, Martiano Murcia, Francisco Cordova, Nasario Jimenez, and Antonio Quintera, ascended the Cararu garape to a settlement of Cubbeo Indians, and were so hospitably received as to be fooled into relaxing the vigilance and close co-operation they had previously agreed upon. As a result, each was shadowed and murdered in the most revolting fashion. A year later at the Jurupary falls a cauchero and his companion, a male Huitote, were transfixed with lances such as are used for killing tapirs, by Indians from just below the caxoeira Mandí. The maloca of these Indians is some 3 miles back from the main river, an ascent up an igarape being first necessary, and then a walk of an hour or more across undulating sandy soiled, densely forested country, with several unbridged streams to cross.

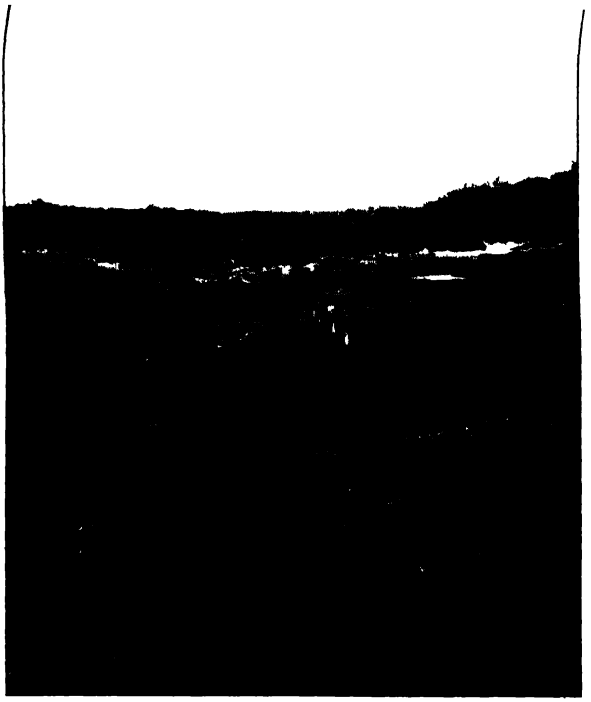
In company with some caucheros and Raimondi, tuçháua of the big maloca on the main river below the caxoeira, the inland maloca was rushed one morning, by which both Indians and provisions were obtained, and the pleasure afforded of meeting the ringleader of the last outrage, who is a much-dreaded character on that part of the river, the entire lot caught asleep in their hammocks. When Indians are absent from the main stream, away on hunting or fishing trips, the caucheroes organize raiding parties, obtain by bribery, cajolery, or threat from other Indians the whereabouts of these isolated malocas, creep up the igarapes noiselessly at night, sling hammocks till the first inkling of dawn, then with Winchesters and machetes, moving cautiously, swoop down on the maloca before the dogs can give warning and the inmates escape. Parley and compromise follow, compacts pledged by the offering and reciprocating of gifts, and the Indians may become valuable allies or the reverse. As a rule, if warning is received beforehand, all inmates of the maloca take to flight after having concealed fowls, food, and personal belongings, not returning till danger of unwelcome intrusion is passed. Occasionally a maloca is found just as its occupants left it, half burned out fires, utensils in their places, hammocks slung, and everything arranged as though the owners' return were but a question of hours, though that maloca is never again occupied—a forest derelict abandoned by its occupants, the mystery and fate of whose disappearance into the vastness and solemnity of the wilderness baffles all conjecture.

Circumstances were such that for two months, between the Jurupary caxoeira and the Cuduairy river, during which time two journeys were made up and down the stream, it was necessary to take part in these predatory incursions, and unrivalled opportunities were given for

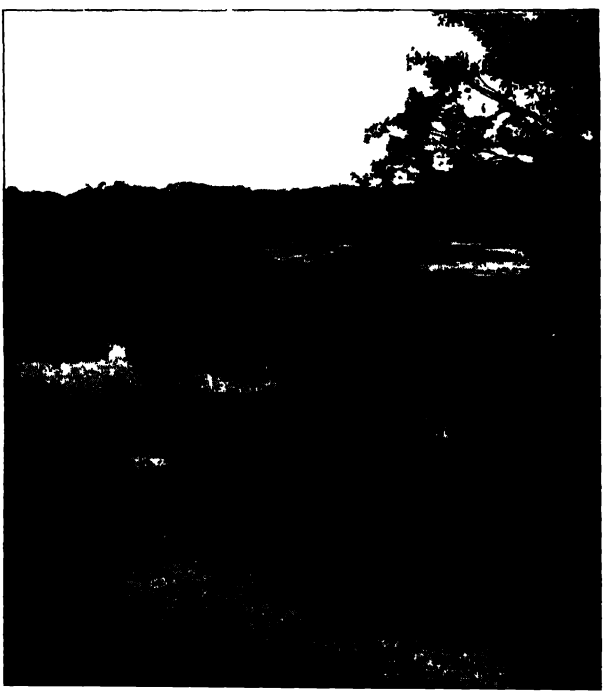


MALOCA OF JOAQUIN, GUAINANO OR QUENANO TRIBE, SITUATED SOME DISTANCE FROM RIVER.





CARURU CAXOEIRA: THE ROCKS ARE GRANITE. ONE OF THE BEST EXAMPLES OF MALOCA ARCHITECTURE EXISTS HERE, WITH CURIOUS PIGMENTED DESIGNS AND DRAWINGS. ON THE ROCKS ARE INCISED STRANGE FIGURES.



studying the Indians under diverse conditions. Taken as a whole, they are simple-minded, sensitive, reserved people, with child-like natures, docile, amenable to kindness, obedient to authority, of great manual dexterity and ingenuity, extraordinary powers of taming birds and beasts of the forest, industrious, amiable, having great respect for each other's rights, belongings, and families, and live in perfect harmony under communal conditions. They lack, however, the inclination and ability for prolonged application in industrial work, and their reticence or shyness about personal appeal gives rise to unpleasant treachery. Their religion is prompted by superstition and fear, in conjunction with the grim grandeur and eerie solemnity of their environment. Monotheism manifests itself in the conception of a being of the jinnee or devil type, which the word "Jurupary" interprets. This Jurupary is not a concrete being, but an invisible and omnipresent spirit which lurks in individual ferocious beasts, as the jaguar, in the unknown recesses of the dark, mouldy, cavernous forests, in the roaring cataracts, in thunderstorms, disease, pestilence, and famine. It is necessary the Jurupary's anger from time to time should be appeased and his goodwill cultivated, which the *tuxaua* do by inaugurating festivals characterized by sottish drinking, strange incantations, curious dances, and weird music on drums, flageolets, piccolos, bassoons, and pounding instruments of crude design, but most effective as noise-producers. The *pagés*,* or medicine men, robe themselves in grotesque dominos fashioned from bark cloth, gaudily painted, the head represented by a black triangle, it being as orthodox that no face should be depicted as is the rubric of ikon in lieu of sculptured image in the Russo-Greek church. The male dancers adorn themselves with cinctures and circlets of feathers, garters of shells, and much pigment. The ritual is an elaborate one of dancing, which continues until copious and protracted libations of caxirí† turn the frenzied activities of the performers into a finale of soporific stupefaction.

They are a people subsisting by agriculture, hunting, and fishing, divided into two classes, an aristocracy and democracy or patrician and plebeian orders. The former is marked by a superior mental as well as physical ability, and among these are included the hereditary chiefs, or *tucháuas*, who act as the pilots in the canoes, leaders in war, appoint the festivals, arbiters of justice, sanctioners of marriage, and in some cases are the *pagés*, or medicine men, who are credited with extraordinary occult powers of exorcism, capable of curing disease, driving away storms, and performing a host of other miracles. Time and again I watched these performances, the technique of which consists in alternate blowing and suction over the affected area of the patient's body, with intermittent pauses for the operator to go behind the maloca to spit out the evil spirit. This, with cabalistic signs and passes, grotesque facial contortions,

* Or payés, or peiis, or pagayers.

† Beer made from mandioca.

and monk-like intonations, completed the treatment, and was of course of the Canute order of efficacy in curing illness or acting as a prophylactic to undesired thunderstorms. Nevertheless the *pagés* do a great business, and their fees are high. To the *tuchána* one must always apply for men; all are subservient to his orders, and without his sanction one may do nothing.

In the communities up the igarapes, where the malocas are from 1 to 3 miles back from the main river, both sexes go about in a state of nudity, or in some cases have a cumari string, from which a piece of bark cloth is suspended. Both sexes are addicted to strings of beads around the neck, and necklaces of jaguars' teeth and claws, tapirs' teeth, and monkeys' teeth are highly prized. The males wear their hair short; the females gather theirs in a graceful knot. Just below the knee a garter is invariably worn, which swells out the calf, and is considered a highly desirable physical characteristic. Among the Indians of the lower river are occasionally seen smooth cylindrical pieces of quartz, similar in size to a 3-inch section of an ordinary candle, and these are known as *itanhuhás*. They are priceless heirlooms, and are hatchments of the *tuchána* or insignias of individuals, who are skilled dancers, musicians, and hunters. A hole is bored, usually through the vertical aspect, sometimes horizontally, and they are worn suspended about the neck as amulets. Wallace states that these come from the upper Uaupés, but this is doubtful for several reasons. It is extremely unlikely that there ever were any settlements of Indians on that part of the river; they are never found among the Carijonas or Cubbéos. What rocks exist are entirely scoriaceous in character and many days from the river, and quartz is not met with until the cataracts of the lower river are encountered. It may be that they come from the Kerary.

Pigments are used extensively, black and red being the prevailing colours. From the genipapa tree indigo juice is obtained, which gives an ink-like stain. This the women allow to be poured upon their bodies, arms, necks, and faces. At other times they strive for a more æsthetic effect, and patterns in encircling bands, punctate spots, chevrons, lozenge-shaped figures, and feathered lines are traced on the bodies, faces, arms, and thighs. The men use a red pigment, carajurú, made from the nut of a tree, and devote most of their attention to the decoration of the face, especially the forehead and cheeks, parallel lines and filled-in triangles being very popular, as well as crossed basketwork and feathered lines.

The Indians do exquisite feather-work, plaited crowns, circlets, and long broad bands being constructed of the feathers of the macaw, garsus, and toucan. Double-toothed combs, which are worn in the hair just below the occipital protuberance, hold feathers from either extremity, and these are never worn except on occasions of feasts, dancing, and

celebrations, but are kept carefully in ingeniously constructed palm-weaved boxes and chests slung from the rafters of the maloca. What semblance of a lobe there is is usually perforated, and short spines inserted. Among the Huitote women, just above the alæ of the nose are borings, and short spines are inserted.

The people of the Uaupés are communal, and big structures known as malocas are built, in which from ten to twenty families dwell. These malocas are surrounded with clearings, in which are cultivated plaintain groves, mandioca and cane fields, pineapple and pepper patches, and fruit-bearing trees of chontaduras,* grapes, and wild cocos. The grapes are usually large, purple, with a syrupy juice and an enormous single stone. The malocas are built on eminences or elevated land fronting the river, and always at the mouths of igarapes, or if inland close by an igarape, and these igarapes are closed by strong weirs stretched from bank to bank with a fence of the tough split chonta palm, which is called a cacurí. They vary from 6 to 20 or even 30 feet in height, according to the depth of the igarape in which they are to be used. Even when a way has been chopped through the cacurí, one frequently finds further progress by water blocked on account of floating *débris* and long low overhanging limbs of trees, both of which act as effective barriers, and so cunningly concealed is the path, that its existence could never be guessed except by the initiated and experienced. Built in the form of a rectangle, the malocas vary from 60 to 120 feet in length, from 40 to 80 feet in width, with a height in the centre of 30 feet, and at the sides from 8 to 5 feet, the thatched roof descending at an abrupt pitch. At the rear a semicircular addition usually exists, which is appropriated by the tuxáua as a special apartment for him and his wives. So far as I could ascertain, these people were for the most part monogamic, but a perquisite of the tuxáua privileges him with several wives. The framework of these malocas are tall, smooth, straight tree poles, with cross-beams and rafters lashed to them by tough vine ropes—everything significant of remarkable manual dexterity. The roof and sides are palm thatch except the front, which for some feet from the ground is constructed of the cascara tree, in many cases decorated in colour with divers designs of diamond and circle or grotesque figures of people and birds. Entrance to the maloca is by a suspended plaited swing door, which pushes inward and is raised before sunrise and lowered at sunset. The centre or great aisle of the maloca is utilized for the big fires, in which the cassava is baked in enormous ceramics of glazed clay with shallow sloping edges, and which are rested over the fire upon spool-shaped supports of clay, the size of some of these ovens being quite 5 feet in diameter. Huge sections of tree-trunks hollowed out into troughs as receptacles for the caxirí, the universal drink, the liquor always neatly covered with broad

* Pupunha or peach palm.

leaves of plantain or palm, also have their assigned place in centre. To each family is allotted the cubicle or space which the supporting posts of the maloca mark off, and in these are kept the family's hammocks, the articles of culinary use, the matafrio, a long plaited telescoping cylinder from which the juice of grated mandioca is compressed. One end is attached above, and a pole inserted through the lower loop; a powerful leverage is thus exerted, and the sap made to exude through the interstices. Among other family treasures are pipkins, calabashes, gourds, baskets and strainers, the Uaupés Indians on the lower river being especially renowned for their clever workmanship of these and wooden stools, which are hewed out of single pieces of wood.

In addition to the household articles are javelins, whose butts are artistically trimmed with plumage feathers, and whose hollow bulbous-shaped coronals are perforated, containing pod rattles; lances used in hunting the tapir, so scrimshawed as to simulate the effect of inlaid pearl work; circular wickerwork shields; long bows and arrows neatly arranged with the tips in a shoe. These arrows are not feathered, there is no slit to fit the bowstring, and the tips are hard chonta, the shafts being guachi, light and stiff; and wickerwork, pitch-covered quivers. They are very skilful in the use of the bow, and there is no more stirringly picturesque sight than, at the sunset hour, to see an Indian poised upon a rock jutting from the river, his torse outrivalling any sculptured ideal. The rippling pliable muscles of the limbs and the bow stiffen and tauten simultaneously, a quick suspense, a fish transfixed in the pellucid water; a ubá gliding swiftly, noiselessly past, impelled by one whose languorous grace and dark beauty of glorious hair, shapely arms, soft sinuous lines of shoulder and waist make her a fitting mate of the bronzed river-god—a scene that appeals through its poetic beauty and sensuous colour as only a touch of Nature truly can. They shoot with the left foot advanced, the bow held vertically, arrow butt grasped by thumb and forefinger drawn to the shoulder. The style is the personification of grace, quickness, and accuracy. From all I could ascertain, these Indians have no knowledge of curari, hence do not use it nor any other poison on the tips of their darts employed with the blow-gun, though curari is used extensively by the Banivas Indians of the Issana river just north of the Uaupés, where a laticiferous vine from which it is made is very plentiful. It is pounded first so as to exude the sap, which is mixed with water, strained, thickened to the consistency of an unguent by boiling, and put into little pots.

Their music is performed on various instruments, chief of which is the mambi, a dozen pipes of varying length and calibre from 3 inches to 1 foot, arranged in concomitant order of length. For hours together an assembled multitude within a maloca will watch a couple of mambi performers execute their dance. It is always done in pairs, and consists

of a quick walk or skip or run up and down the centre of the maloca after the fashion of a goose step; each time the right foot touches the ground the cadence is accentuated by a stamp, as is the turn and termination, which is most abrupt, steps and music ending suddenly together; copious draughts of caxiri being tendered them, it is as suddenly resumed. The music is a simple melody, not unpleasing, though its repetition grows monotonous. Up the Tapiri igarapé, whither I was carried by a rescue flotilla of Indians and canoes from an island marooned by deserters, I witnessed one of these performances, which lasted from sunset to sunrise, and it was here that Jurupary music was at its highest development. It is surprising with what inimitable grace and litheness the mambi step is imitated by the veriest tots of boys, whom I have watched countless times with amused admiration as they pranced up and down the maloca. The imbáubas are long hollow cylinders of wood surmounted with a handle and closed at the bottom. They are pounded in unison as the dancers lunge and stamp. Flageolets are constructed from the jupati wood and the long bones of animals, and a piccolo, known as a bocini, is made from clay. Dried shells of the wild coco are tied together in large clusters, which are fastened about the legs and shaken, and maracas, which are dried gourds filled with pods and used as rattles. Then there are drums of various sizes up to the big one of the Tucanos, known as a trocana or botuto, a hollowed log 5 feet long and large circumference with the ends enclosed, and along its longitudinal surface four holes large enough to admit the fist. The log is slung by a cradle of rope from four posts usually surmounted by grotesque and crudely carved heads. This is played upon with batons, whose wooden handles are surmounted with heads of rubber the size of a cricket-ball, and the sound produced can be heard several miles on a quiet night.

A far more lugubrious noise is the Jurupary music, produced by an instrument of two forms, one resembling a gigantic megaphone, and the other a huge bassoon. These are made from the paxiúba, and no women may gaze upon this instrument under dire penalty of death, which accounts for night being frequently made hideous, as a more propitious time to practise; though without doubt this, in common with the severe flagellation inflicted upon females coming of age, which, if they survive, constitutes their *debut* and signifies their eligibility for marriage, as well as the disinterment of corpses several weeks after burial, when the decomposed remains are incinerated and the ashes put into the vats of caxirí to be partaken of by those attending these grisly memorial services, is becoming more traditionary than customary upon the river.

The question of childbirth is a comparatively simple one for the mother. During the term of pregnancy she is supposed to abstain from all food of meat and fish character, but at any time her share of this is

not large, as the men eat together from a single dish, using their fingers, and what is left the women and children have afterward. At the time of parturition she retires into the forest—if done in the maloca, a very vexatious removing of all utensils and belongings is entailed—and is there delivered, assisted by one or two other women. Complications and twins are both unknown. Both mother and child return to the maloca within a few hours, where the sire is found in his hammock, a victim of the fixed idea that upon him is visited the necessity of *post-partum* precaution, as he regards himself as an ill man and is so considered by others. Whatever this form of malingering could be classified under, whether ascribed wholly to hysteria or to some curious process of sexual affinity, would be hard to determine. Mothers carry their young straddled across the right or left hip, usually the latter, supporting the child by passing her arm beneath the infant's axillæ. This allows her great freedom of movement, whether walking or in the canoe, rendering her at all times a valuable assistant to her husband when engaged in hunting or fishing. The infants in this position nurse easily, as the breasts are of the long conical type, pointing markedly outward and downward, firm and resilient till the menopause, when they become atrophied into great loose pendulous folds; though they seem singularly free from any of the pathological conditions so commonly associated with civilized woman during this period of degenerative change.

The Cubbeo Indians, as the Guayibas, Carijonas, and Huitotos, bury their dead within their dwellings, but whereas the Guayibas and Carijonas then abandon their houses, the Cubbeos and Huitotos are of a more economical frame of mind and do not. The Uaupés Indians, for the most part, bury their dead outside the malocas. At Yutica, which I reached late one night, I was shown a young Indian woman merging into a moribund condition, suffering intense agony. To render her last hours more bearable, I injected quarter of a grain of morphin, and the result, in contrast to anything the pagé had been able to effect, produced a profound impression among her Indian brethren, the needle becoming for the moment an object of far greater curiosity than the big ·405 bore rifle or sextant or camera. A few hours after midnight the woman died, and from then till burial, a little before noon, was one uninterrupted session of weird wailings, loud lamentations, mournful incantations, convulsive sobbings, in which all the residents of the maloca from time to time took part, putting their arms about one another's necks, repeating incessantly the word "guenig, guenig." In a hammock, an old woman, in a garrulous monotone with rising and falling inflection, was supposed to mitigate the Jurupary. At dawn the husband went forth, as is the custom, with his arms to shoot the evil spirit. A small ubá of 10 feet in length was cut in halves, made into a coffin, and in this box was deposited the corpse in her hammock. By doing a major share of the

lifting, straightening the limbs, folding the arms, and adjusting the head, as most of them seemed reluctant to touch her, I was enabled to make a tactile examination of the abdomen, but they resented any proposal for autopsy, which I was most anxious to do, as the case presented an interesting condition of acute beriberi. In the coffin was put most of the personal belongings of the deceased, a sliced gourd over her face, some food, and many contributed some little trinket of his or her own. The contents of a basin of potassium permanganate, in which I was washing up after the cursory *post-mortem*, they were especially anxious should be included, its rich claret colour attracting them tremendously.

A quarter of a mile behind the maloca a hole was dug with paddles, its depth measured by the middle third of the men's thighs; into this the casket was lowered while the assembly stood or sat in apathetic fashion. There were no exercises, nothing more than an impressive silence; then each contributed his or her handful of earth to help cover the grave, completing the obsequies. In the afternoon came caxiri-drinking and a state call from a Desana chief of the Macu garape, a tributary of the Papory, who came to pay his respects while passing, gorgeously painted and attended by arm-bearers and concubines.

The Uaupés Indians seem curiously free from the most dreaded diseases of civilization, such as cancer, syphilis, and the ubiquitous appendix. Fever due to malarial infection or simulating such is common, as are large spleens and livers. In the territory of the upper river mosquitoes abound, and rest at night is impossible without nets. On the lower river they are absent for the most part, and infection, if due to malarial parasites, must be transmitted by a host or means other than the anopheles. One case I saw of possible leprosy of the nodular variety, and sporadic cases of beriberi are frequent.* They are very susceptible to, and especially dread, influenza, or "deflux" and "catarrho," as it is variously termed. Eye diseases are extremely common, especially conjunctivitis. Infant mortality is high, on account of intestinal diseases of protozoan and helminthic origin. Both carati or pinta and eczematous conditions are common. Bronchitis is frequent, due to the Indian's heedless exposure; but rheumatism is noticeably absent, and so is tuberculosis, though with the growth of the rubber industry and increased invasion of the white man, with consequent hybridization, will come his two aborigine annihilators, syphilis and tuberculosis; and the old order of things will pass away for ever, succeeded by a modernity to be accomplished probably by the sewing-machine and disease.

* Caused possibly by some agent or action of mouldy farinha similar to that attributed to unwashed rice as a cause of beriberi among Eastern people—a theory which, however, while strongly supported by circumstantial evidence, is not yet a conclusively proved and scientifically established fact.

Splendidly strong, well-woven hammocks are made by the Guainanos and Tarianos upon looms one or more of which are found in their malocas. The batten of the warp and woof is always a stick of polished pira-miranga, a dark red, intensely hard, heavy wood highly prized by the Indians. The Huitotos, Carijonas, and Cubbeos employ no loom, nor are the fibres woven, the longitudinal strings merely tied at regular intervals with cross-meshes, by which the initiated eye knows at once what tribe it signifies; for the Huitotos space the distance that the thumb and little finger outstretched subtend; the Carijona meshes are at a palm's distance apart, including thumb; and the Cubbeos is measured by four fingers.

The tipiti is the Indian cane-mill, or trapiche, and is made by two stout posts planted firmly in the ground, with perforated borings to support the extremities of two smooth rollers in close apposition, each made to rotate from either end by detachable levers. The cane is fed through this crusher and reduced to bagasse, the juice being caught in earthern and wooden vessels. The pilon and mano are huge wooden mortars and pestles, a hollow tree-trunk and a heavy pounder hewn from hard wood with a cylindrical head employed for crushing maize. These, with the matafrio previously mentioned, complete the crude mechanical devices in common usage with these people for ages past.

March 12 I reached the Ipanoré caxoeira, and two weeks later we passed down river to San Joaquin, and shooting the Tamandúa caxoeira, were hurled into the whirling waters of the Rio Negro April 1, reaching Santa Izabel, the head of steam navigation, four days afterward.

THE CAMBRIDGESHIRE RIVERS.*

By the Ven. W. CUNNINGHAM, D.D., Archdeacon of Ely.

[ABSTRACT.]

HAVING been called upon lately to write a short economic history of Cambridgeshire, I found that the story of half the country was very closely involved with that of the river system of the Fens. This had been interfered with from time to time by the digging of channels and erection of banks; but these great works do not always tell their own story: some channels were made for purposes of drainage, and some for navigation; some banks were meant for protection against flood, and some to be used as roads. The dates and the objects of most of the works are very uncertain, and the problem as to the course of the river before the artificial changes began is one of great difficulty. I make no pretence of having solved it, but I venture to put forward some pieces of evidence which ought to be carefully weighed by any one who takes up the question seriously, from the hydrographical side, and not as I have done, merely incidentally, and from the historical side.

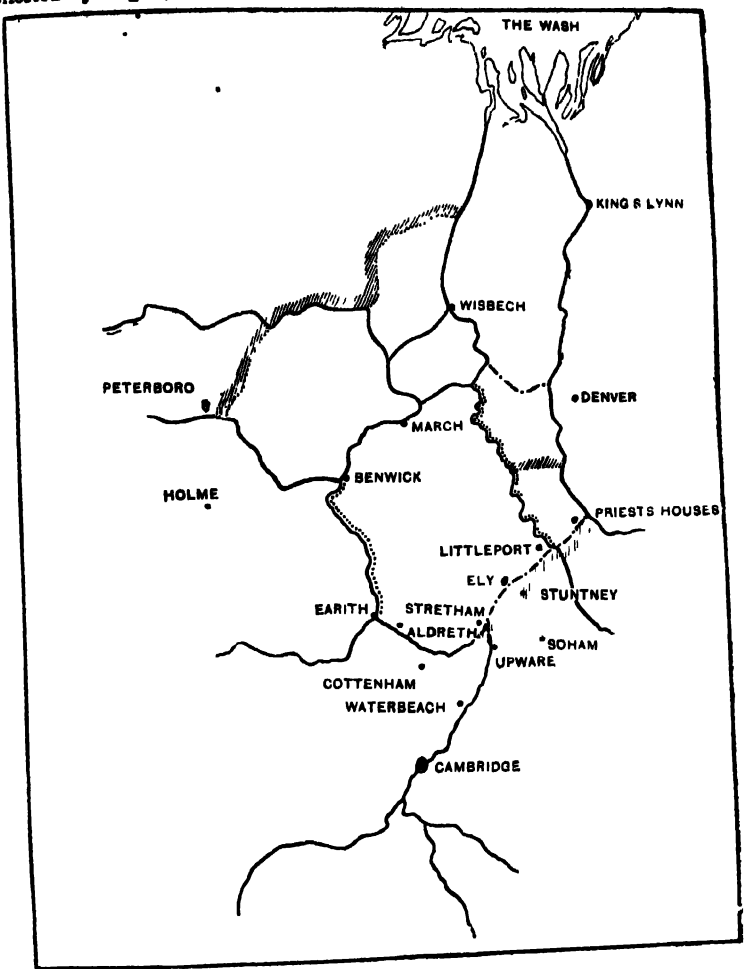
The face of the country was entirely changed by the systematic drainage which was undertaken by Cornelius Vermuyden and carried through during the seventeenth

---

* Research Department, February 22, 1910.

century by the Bedford family, and the map represents the country as it was in 1605, before this attempt was begun.

I. The *historical evidence*, as gathered from records and traditions, has been collected by Dugdale, and printed in his 'History of Imbanking,' he gives good



-·-·-·- New channels opened.

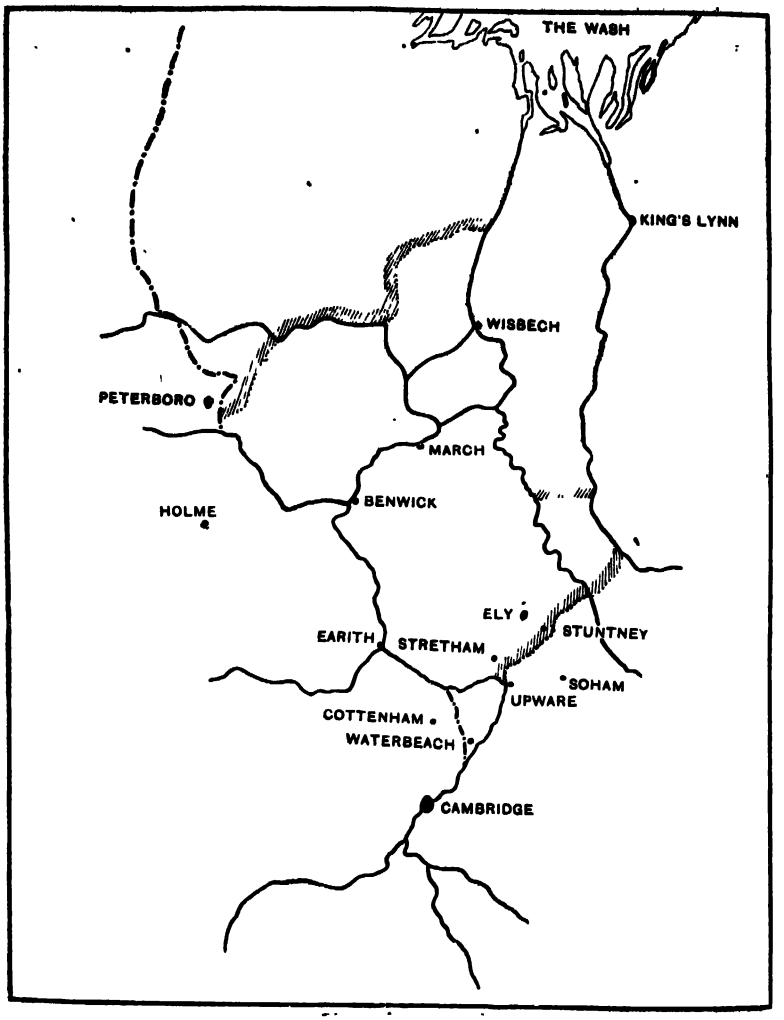
..... Old channels silted up.

The boundaries of the Isle of Ely are shown by the rivers and hatching.

MAP I.—CHANGES IN THE CAMBRIDGESHIRE RIVERS AFTER THE STOPPAGE OF THE OUTFALL AT WISBECH IN 1236.

reason for believing that during the preceding three or four hundred years, the Ouse and the Cam had been so far diverted that, whereas the water had formerly been discharged at Wisbech, it was in his day carried to the sea at Lynn. It is probable that this change began in 1236, when there was a great storm at Wisbech, and the

outfall was blocked. As a consequence, it seems, a channel was formed from Outwell to Denver, and another cut from Littleport to Priestahouses, thus carrying the whole of the water to Lynn. Navigation which involved the use of these



MAP II.—CAMBRIDGESHIRE RIVERS IN ROMAN TIMES.

channels was firmly established by 1302. It also appears that at the time, when the outfall at Wisbech was blocked up, the Nene had tried to force its way against the current of the Ouse, from Benwick to Earith;* and this seems to have resulted in the silting up of that channel before 1605.

* Badeslade, 'Navigation of the Port of Lynn,' p. 6.

Map I. shows the new channels which enabled the waters of the Nene, Ouse, and Cam to be discharged at Lynn, and indicates the old channels towards Wisbech which have silted up.

II. It may perhaps be taken for granted that the English settlers who formed agricultural villages would *accept physical obstacles to communication as natural boundaries;* they could not work their common fields and pasture their stock conveniently on both sides of a river; where a channel cuts across such a parish, there is reason to believe it is artificial. The present course of the Cam and Ouse cuts across the parishes of Waterbeach, Wicken, Stretham, Ely, and Littleport, and we may infer that these channels are later than the English settlements. The old name of Looder or Lorder Delfe, preserved in the map of the Fens published by Hondius in 1632, suggests a much more recent origin. But the further question arises, what was the previous course of the river? It has been traced along the boundaries between Ely and Stuntney by Mr. Cole Ambrose; and the quantity of remains he has dug up render it certain that the Romans had a quay at Stuntney, about three-quarters of a mile from the present course of the river. This channel has long since been completely silted up. Supposing this process to have begun in Roman times, it appears possible that the water of the Cam forced its way from Upware round to Earith, and joined the Ouse on its way to Benwick, and that the original course of the water in the West river was from east to west. Mr. Arthur Bull, of Cottenham, has found much evidence which goes to show that this was at one time the course of the river at Aldreth. It is confirmed by the old description of the extent of the Isle of Ely (A.D. 974), and by the boundaries of the rights of warren assigned to Cambridge Castle in 1274. The critical point in this connection is Wash Lode, which seems to be entirely forgotten, but which can be identified from some very curious maps in the parish chest at Stretham. Among the same papers there is an interesting award of 1298, as to the pasture rights of the people of the parishes which would be affected when the thirteenth-century channels were cut through them.

III. We are thus brought back to Roman times, and to a remarkable channel from Clayhithe to Cottenham, known as the Car dyke. This would serve as a link in a system of internal waterways by which the best corn-growing land of Cambridgeshire was connected with Peterborough and Lincoln. The distribution of Roman remains in Cambridgeshire seems to show that they relied on communications by water; and the royal rights of the Saxon kings over the waterways * correspond to those they claimed over the great roads. The hypothesis I have put forward as to the course of the rivers may be of service, if it helps to focus attention on the crucial points—the date and causes of the silting up of the Cam at Stuntney, and of the silting up of the Ouse from Earith to Benwick. I have been content to accept the sections of the country made by the eighteenth-century surveyors, but of course the levels should be re-investigated. On this point I would direct attention to the hydrographical observations of (?) William Hayward in the Harleian MSS. in the British Museum (Harl. 5011 f. 21). Dugdale made use of this, but omitted many interesting details as to the feeders of the Cam, their direction and the quantity of water they contained. I am well aware that the hypothesis I have put forward bristles with difficulties, and I will only say that the only one of these difficulties which I have tried to face—as to how King Cnut rowed to Ely, if there was no river there—does not appear to me insuperable.

Dr. Strahan: This has been a most interesting account of the fenland rivers. That they have frequently changed their courses is obvious; indeed, rivers in an

* 'Domesday Book,' I., 298 b. 1, also 'Laws of King Edward the Confessor.'

area of obstructed drainage of that kind must always be changing their courses, and, if left alone, will certainly change them again. No doubt in the paper there is further evidence than we have heard as to the date on which these changes have taken place, but, so far as I have been able to judge, the actual dates of these changes are, in certain cases at any rate, mere hypothesis. There was one example I might mention. No evidence was brought forward of the Car dyke being Roman; it was stated as a matter of opinion, and although I do not for a moment say it was not correct, still we are accustomed to look for proof of such matters. The paper is one which should lead to an interesting discussion, and I will now invite remarks.

Dr. J. W. Evans: I am sure we would welcome many papers such as this which give us information with regard to the geography of our own country in the past. This is important, not only for the sake of Geography itself, but for the understanding of history, and a great deal more might be done in the same direction. I must demur, however, to the author's argument that a parish extending across a river is proof that the river had once a different course. I agree that the boundaries of parishes are often of great antiquity and important as historical evidence. In fact, all ecclesiastical boundaries are of historical importance, because they are, as a rule, maintained unaltered through long periods of time. It is well known that in France the episcopal dioceses represent some of the old tribal boundaries, which ceased to exist for political purposes over one thousand years ago. But I cannot believe that in a country like this, where the water is made use of to such an extent for the purpose of locomotion, the area which was cultivated by a particular settlement would be confined by a river as its boundary. I know something of primitive communities in different parts of the world, where they are, I should imagine, in a very similar state to that of our ancestors when these parish boundaries were drawn, and my experience is that in cases where such a community has settled on a large river, it nearly always has farms or plantations both immediately opposite the village, and down-stream sometimes at a distance several miles, and the agricultural ground belonging to a village is therefore apt to be scattered about on both sides of the river wherever the ground is favourable. I may add that I think a careful study of these streams might enable us to attack the problem whether there has been any variation in level within historical or late prehistorical times I should like to ask the author whether he has considered that question. In conclusion, I must congratulate him in bringing forward a valuable paper of a type of which, as I have said, we should like to see many more.

Dr. Cunningham: I am very much obliged to you for the kind way in which you have received this paper. I will say just a word or two about one or two of the questions asked. In the first place, I quite acknowledge that the dates are very uncertain with the exception of 1236, which I think we may take as the time when the Wisbech outfall was blocked up, and the forcing of the water towards King's Lynn took place. I think that is a definite date. With regard to the three alternative routes—the present route from Cambridge *viâ* Ely to Littleport, the Stuntney channel, and the Wash Lode channel—I do not think there is any evidence as to the dating or even as to the relative order in which the water went by one rather than by the other; the only suggestion is, I may say, that since there was a living tradition in regard to the one route, and no living tradition in regard to the other, the channel to which the living tradition attaches is probably the later. The remains show that it was used by the Romans, though it may be pre-Roman; and we have no evidence of any persons who were able to undertake a great scheme of navigation of this kind since Roman times. It is very difficult to believe that anybody would have undertaken it in the long period of the Anglo-

Saxon kings. In regard to the parish boundaries, I entirely agree that it is not by any means conclusive. At the same time, I think in the case of those particular parishes where there is a great deal of land that is mostly used and probably has been used for pasturage, and where there are little bits cut off from the rest of the pasturage of the village, it is rather difficult to conceive that these small detached pieces were part of the original of the pasture of the village. Farther down in the Fens, where they did not pursue cattle-rearing so much as they did in those villages, and where they were much more dependent upon fishing, I think the waterways were much more important and were communicating links; but in this particular place I have difficulty in regarding it as consistent with the ordinary village economy, so far as we know about it from the period of the early settlement. The nature of the parish boundaries first called my attention to the probability of this being artificial, but I think the real reason for arguing that the present channel is modern, depends principally on the traces of the two older courses that are now silted up. In regard to the levels, I have gone entirely by the eighteenth-century surveyors. I feel that the question of the levels is all-important, but it is outside my sphere, and I have not attempted to check the levels that are given in the ordinary books about the Fens.

CANADA'S FARTHEST NORTH.

By Miss AGNES DEANS CAMERON.

On February 25, in the Theatre, Burlington Gardens, an illustrated address on the above subject was delivered by Agnes Deans Cameron under the auspices of the Society. Miss Cameron is at present in England as the representative of the Government of Canada, her mission being to give a series of lectures before representative bodies in the United Kingdom with the object of disseminating a more correct knowledge of the Dominion of Canada, its resources and opportunities, than has hitherto obtained in the Mother Land.

The chair was taken by Admiral Sir Lewis Beaumont. A feature of the address was the collection of lantern views illustrating the lecturer's journey in 1908 to Canada's Farthest North. The expedition occupied six months' time, and covered a distance of 10,000 miles, most of it through little-known country. Miss Cameron followed the Mackenzie river to its mouth, and returned to civilization by the Peace river and the Lesser Slave. This is the first time this has been accomplished by any traveller in one season "between ice and ice."

An exhibit of the tools, ivory carving, articles of clothing and adornment of the Nunatalmute and Kogmollyc Eskimo from the Mackenzie river delta was placed on view. A collection was also shown of the representative flora of the basins of the Mackenzie and the Peace.

Travelling from Edmonton, "the end of steel," for 100 miles by horses, Athabasca landing was reached early in June. The journey from this point to the Arctic was largely by boat, and followed the interior waterways—the Athabasca river, Athabasca lake, Slave river, Great Slave lake, and the mighty Mackenzie—to the ocean. Journeying under the kindly segis of the Hudson's Bay Company, the traveller was given opportunity to inspect the old-time records of the fur traders in their various posts. From this mine of unpublished lore more than one illuminating excerpt was made, which shed new light on the story of Sir John Franklin. It is impossible to point to one geographical expedition, one scheme

of scientific endeavour with Canada for its field, which has been carried to its consummation without substantial aid from the Hudson's Bay Company.

At the very Arctic edge the lecturer established another interesting link between the present and the half-forgotten days of M'Clure's voyages in the early fifties. It will be remembered that M'Clure reports having made a present of a piece of red cloth to a little Eskimo girl on Banks' Land, eliciting from the child the quaint question, "Of what animal is this the skin?" Miss Cameron learned from the whalers at Herschel island of the meeting a year previous to her journey between the captain of the whaling ship *Olga* and this very Eskimo child, now a bent and aged crone.

Perhaps of greater historical and geographical value than any other picture shown was the view of the site of forgotten Fort McLeod, a spot for the first time photographed by the lecturer. It was from this far point on the Peace that Alexander Mackenzie in the spring of 1793 launched his canoes on that empire-making journey which found final goal on the Pacific edge, the journey which enabled him to write in vermilion letters on the black rock of the British Columbia coast the inscription, "ALEXANDER MACKENZIE FROM CANADA BY LAND, 1793." Mackenzie was the first man to cross the American continent from ocean to ocean north of the latitude of Mexico, and there is considerable satisfaction in the thought that the Hudson's Bay Company is sending a tablet suitably inscribed to this point that the site of the historic camp will no longer remain unmarked.

The lecturer's message regarding the big game of sub-Arctic Canada is one of optimism. She reports that the herd of 350 to 500 wood bison on the Slave river is maintaining its own numerically, being protected by a special detachment of the Royal North-West Mounted Police from its two possible enemies, the timber wolf and the Fort Smith Indian. Regarding the reindeer or Barren Land caribou, there was no report of the diminution of the herds. The musk-ox still holds his own on that great stretch of country lying north and east of Great Bear and Great Slave lakes, a country which the lecturer declared to be covered with herbage, and to be "barren" only in the sense that it is treeless. Miss Cameron shot a moose near the Peace River crossing. Thirty-pound trout rose to the fly on Athabasca lake, and splendid grayling were taken on the north shore of Great Slave lake.

Old Fort Simpson in lat. 62° N. was found to be rich in records. Here lie the mouldering remains of America's Farthest North Library, and here, too, the journals of the fur factors are lush with records of the long ago.

Off the delta of the Mackenzie, the circumpolar or Arctic bowhead whale (*Balæna mysticetus*) is making his last stand, and unless a close season is enforced, this cetacean will soon pass out of the drama of Arctic life. Each of these floating tanks of baleen and oil nets his lucky captor from £2000 sterling upwards, and to-day this Mackenzie delta whale-industry is entirely in the hands of enterprising Americans with headquarters in San Francisco harbour. Since the year 1891 the catch in these waters has been 1345 whales. Ignoring the oil altogether, and putting the "bone" (baleen) at 2000 pounds each whale, the value of 1 pound of bone being £1 sterling (both conservative figures), we find that more than 2½ millions sterling in whale-values have gone out of this Canadian sea-pasture by the back-door route.

A trade in fur also makes out by this Pacific-Arctic Arctic-Pacific route. The lecturer estimates that total products of the value of £300,000 sterling find their way each year out of Canada in the ships of this whaling fleet.

The agricultural possibilities of this Great Lone Land are great. Pictures were shown of wild flax blossoming far within the Arctic Circle, and of golden-rod and wild roses manifesting on the edge of the Arctic ocean; potatoes, turnips, carrots,

and parsnips are cultivated at Fort Good Hope, on the Arctic Circle. It was a revelation to learn that the wheat which took the highest award in the Philadelphia Centennial Exposition in 1876 was grown in the little garden back of the Convent of the Grey Nuns at Fort Chipewyan, on Lake Athabasca, in lat. 58° 40′ N. A flour-mill belonging to the Hudson's Bay Company, which for a decade has been grinding into flour wheat grown in the pleasant pastures of the Peace river, in lat. 58° 30′ N. (and 400 miles as the crow flies north of any existing railway) proved a picture illuminating and suggestive.

The world knows that in Western Canada, between the Great Lakes and the Rockies, and extending north from the United States boundary to the Saskatchewan river, stretches a great wheat-plain 1000 miles in length. The building of the Canadian Pacific railway brought this rolling mesa out of obscurity into



SITE OF ALEXANDER MACKENZIE'S LAST CAMP ON THE PEACE RIVER WHENCE HE SET OUT OVERLAND FOR THE PACIFIC, 1793.

opulence. To-day it is the melting-pot of the nations, the goal of the greatest economic trek this world has ever known. The lure of the free wheat-farms which the Canadian Government is offering in these prairie provinces, brought last year 100,000 American farmers northward into Canada from their own northerly tier of states, and an equal number surged into these wheat-plains from the Mother Country and the hardy nations of Northern Europe. In this occupied belt of Western Canada lie 200,000,000 arable acres, and as yet but one-twentieth of this land has been brought under the plough.

It is not generally known that north of the Saskatchewan, in the valleys of the Athabasca, the Slave and the Peace lies an untouched heritage, a great hinterland of another 100,000,000 acres of land capable of growing No. 1 Hard wheat. Faith in wheat took the railroad into Edmonton-on-the-Saskatchewan; faith in wheat and timber, and furs and fish and oil, and salt and coal measures will take the railway into the Athabasca and the Peace.

Vermilion-on-the-Peace, in lat. 58° 30′ N., is in the heart of a rolling, alternating prairie and bush-grown country extending back 50 to 80 miles—up-river on the west side 300 miles, and down-river 100 miles, an extent larger than Belgium with her 7,000,000 souls. Wheat has been grown in Vermilion for thirty consecutive years; two years ago 30,000 bushels was the output from 1000 seeded acres. One can read a newspaper in July at midnight in Vermilion in the open air, and wheat matures from seed-sowing to seed-garnering in ninety days. It is the eighteen hours of sunshine out of every twenty-four which matures here so quickly these crops of yellow Ladoga wheat.

Proceeding south from the Hudson's Bay Company's post at Dunvegan-on-the-Peace, we reach the Grande Prairie by passing through the fertile lands of the Spirit river. Grande Prairie is a loose term given to an area of 3500 square miles of black-country. The Pouce Coupe would seem to be the most attractive of all the Peace river prairies; peavine and blue-joint hid a horse in mid-August, and berry-vines showed no touch of frost by mid-September. Chinook winds drift in through three mountain passes, tempering everything they touch. It is a paradise for wild animals; rabbits seek the peavine, the lynx and the fox follow the rabbits, and the bear finds the berries that tickle his pala'e—blackberries, strawberries, cherries, willow-berries, and saskatoons.

In mid-April the banks of the Peace river in lat. 56° are white and mauve with flowering anemones. These harbingers of spring brighten the land around Hudson's Hope and Fort St. John in point of time actually earlier than they appear hundreds of miles to the south and east. Spring opens in April, warm weather sets in, and the heat increases until mid-August. The month of October is a living glory; and if the winter is cold, is it not also salutary? One turns over the heads of Peace river wheat and dreams greatly. They average four, five, and six grains to the fascicle; Ontario wheat, and that grown in the Northern United States runs from two to four grains to the fascicle. What do we read here? It was the Central Asian plain in the past which produced all the world's grain and fruit and men of might. The valleys of the Athabasca and the Peace are its Western prototyps.

Further details concerning this report will be found in Miss Cameron's recent work, 'The New North.'

REVIEWS.

ASIA.

The North-Western Borderlands of India.

'The Gates of India: being an Historical Narrative.' By Colonel Sir Thomas Holdich, K.C.M.G., etc. London: Macmillan. 1910. 10s. *net.*

No better qualified author than Sir Thomas Holdich could have been found to take up the parable of the late Sir Henry Rawlinson, and expound to us the geographical problems of the regions to the north-west of India, especially those that have become more clearly revealed in the light of the surveys and explorations of the past thirty years. For among modern surveyors and geographers Sir Thomas may truly claim *pars magna fui*. He has traversed and studied most of the regions between the Pamirs and the Persian gulf, and may be accepted as an authority at first hand on those extraordinarily interesting countries which even now, in spite of all efforts, include large tracts of *terra incognita* that call for scientific examination. From many points of view 'The Gates of India' will serve as a useful bringing up to date of 'England and Russia in Central Asia,' the first comprehensive text-book on its momentous subject-matter. But while

Rawlinson had a distinct political object in view, *i.e.* to arouse his countrymen to a keen perception of the then critical strategic position of the two rival powers, and to warn Englishmen of the danger of allowing Herat to fall into the grasp of Russia, Sir Thomas Holdich's work sees the light in less dangerous and troublous times. The demarcation of the northern boundary of Afghanistan, the Russo-Japanese war, and, later still, the Anglo-Russian agreement in respect of Persia, have profoundly modified the general situation, for the time being at all events. Thus the present is a convenient moment to take stock of existing geographical knowledge, and Sir Thomas's notes, amassed, as he tells us, in the course of his twenty years of official wanderings, will serve the purpose admirably. Many of these shed light on the ancient highways and cities of the past, and, to do justice to this important aspect of India's trans-frontier annals, the author reviews in turn the early movements between East and West, the march of Alexander the Great, in its various stages (including the still obscure, but ever-absorbing retreat through the Makran deserts), and the Arab conquests and migrations of the Middle Ages, from the eighth to the eleventh centuries. On the latter topic the author's comments are specially instructive. He has himself dug over Arab tombs in Sind, he has rummaged among the tons of pottery and miscellaneous ornaments washed out of ruins in the Helmand valley, and hence throws much-needed light on Idrisi's and Ibn Batuta's researches. Makran, again, barren and uninviting though it be, has a special interest in his disquisition through the numerous identifications of places described by Istakhri, through memories of the lost armies of Cyrus and Semiramis, and of other great movements inspired more or less by the consciousness all the time of the fact that the key to the golden gate of Indian commerce lay behind those barren Makran hills.

The ensuing roll of British explorers is ably reviewed, from the days of Christie and Pottinger, just a century ago, down to the present day. Among these the researches of Masson—an American traveller, by the way—are exhaustively and lengthily considered, for the author esteems the information accumulated by that adventurous explorer very highly. Lord, Wood, Moorcroft, Burnes, Vigne, and Ferrier next occupy attention and comments, and highly fascinating these are. "The last named," the author characteristically observes, "is one of the most interesting, and at the same time one of the most disappointing, of modern explorers, for it is just where, as a geographer, he leaves the known for the unknown and makes a plunge into a part of the country which no European has actually traversed before or since that he becomes disappointing. He is the only known wanderer from the West who has traversed the uplands of the Firozkohi plateau from north to south, and it is just that region of the upper Murghab basin which our surveyors were unable to reach during the progress of the Russo-Afghan Boundary mapping." Is this, by-the-by, quite correct? We ask with diffidence, but we were certainly under the impression that one of the sub-surveyors attached to the Afghan Boundary Commission, Hira Singh, completed a survey of the Band-i-Turkestan range and the upper Murghab river, in the Firozkohi country, and that his colleague, Imam Sharif, worked down south through the Taimani country into Zamindawar. This brings us to the mention of another remarkable journey on which we should have liked to have had the benefit of the author's remarks, and that is Lieut. Conolly's route from Cabul to Herat. Extracts from the journal were published in the *Calcutta Review* many years ago, but the journal itself appears to have been lost, and we are not aware that it has ever come to light. The late Sir Henry Rawlinson did his best to unearth it, and made many inquiries and researches, but without success. It would certainly prove a highly interesting find to any ransacker of Indian records. Another still more

important source of information would appear to have escaped Sir Thomas Holdich's vigilance, and that is the voluminous fund of geographical data amassed by the late Major Raverty. This erudite and indefatigable Orientalist has left on record a most extraordinary collection of papers bearing on Afghanistan and adjacent countries, all of them culled from Oriental works which the major, as a truly expert linguist, spent his life in translating and annotating. His 'Notes on Afghanistan,' undertaken at the request of the India Office, and continued with scantiest of encouragement through a long spell of years, contain a valuable store of topographical, historical, and ethnological data, which certainly call for utilization. Unfortunately, Major Raverty had his peculiarities. He was almost a fanatic on the subject of accurate transliteration; he was terribly severe on what he deemed the mistakes of other authors, and he lacked the power of condensation. Hence his writings, in spite of their historical and scientific value, have rather repelled than attracted other students and writers. At the same time their importance is incontestable, and it is to be hoped that some effort may be made to compile a synopsis of the voluminous 'Notes' in question as well as the same author's translation of the Tabakat-i-Nasiri, or the history of the Muhammadan dynasties of Asia from 800 to 1300 A.D. The geographical harvest alone would more than repay such a task.

In conclusion, we must express our gratitude to Sir Thomas Holdich for his important contribution to Central Asian geography in the present volume. The "Summary" at its close seems to point to a junction across Afghanistan of the British and Russian railway systems as the best way to approach the land-gates of India. Whether this is a correct view or not it would be premature to say, but there can be no doubt that the author is doing good service in reminding us that this aspect of the general question urgently demands investigation at the hands of those to whom the guardianship of the land defences of our Eastern Empire is entrusted. C. E. D. B.

Western China.

'Across Yunnan.' By Archibald Little. *Map and Illustrations.* London: S. Low. 1910. *Price* 3*s.* 6*d. net.*

Mr. and Mrs. Archibald Little have made many valuable contributions to our knowledge of China, and the present volume derives a melancholy interest from the fact that it is an account of the last journey in China which Mr. Little—a veteran traveller—was fated to make. Mrs. Little accompanied her husband and is therefore well qualified to edit and revise the newspaper articles which he originally wrote. Mr. Little had a very long experience of China and travelled extensively, so that his knowledge of the country and its people was deeper and more intimate than that usually possessed by the resident in Treaty Ports. His name will doubtless be chiefly remembered for his enterprise in showing that steam navigation was possible in the Yangtze Gorges, and it was natural that he should have desired to see what is to some extent a rival line of entrance into Western China.

Mr. Little fully appreciates the enterprise of the French Government in pushing their railway from Tongking into the heart of Yün-nan. As a counterpoise to this he is in favour of a British railway from Burma into Yün-nan, though it is doubtful if he is quite correct in saying that this western route "presents fewer natural difficulties than those which the French are successfully surmounting in the east." Eventually he thinks "a railway along the West River valley will provide the easiest and most natural means of access from Canton and Hongkong to the Yunnan plateau." Full justice is done to the excellent climate of Yün-nan, in which Europeans can keep their health and the crops of the temperate zone can be grown—

a striking contrast to the heat and malaria of Burma and Tongking. The greater part of the book is a very pleasantly written account of the travels of the author and his wife through a most interesting and picturesque country. Some very clear photographs—some of them by Mrs. Little—illustrate the narrative.

To criticize some small points—the year in which the journey took place is not given. Yün-nan does not alter much, but in a book of travel it is useful to know how recent the information is. Also Mr. Little's intimate knowledge of China occasionally makes him use without explanation words (*e.g.* Futai, Fengshui) which are not familiar to the ordinary English reader.

The map is a very rough copy of a map of Yün-nan published by the War Office, with a few additions from the author's sketches. A somewhat serious omission is the line of the French railway, which might have been copied from the original.

H. R. D.

'Leaves from an Afghan Scrap-book.' By Ernest and Annie Thornton. (London: Murray. 1910. Pp. xvi., 225. *Map and Illustrations.* 8s.) Mr. Thornton has been for many years in the employment of the Afghan Government, and his book gains interest from the unusual nature of his task, which was to develop the leather industry. His work brought him into frequent and pleasant contact with the Amir, and if his relations with the Amir's officials were often other than pleasant, owing to their peculiar methods, his success in introducing British methods of boot-making and other branches of leather-working is obvious from these pages. Meanwhile his wife brought English cookery into favour in high Afghan circles, and the close relations of both with the natives has provided them with a host of instructive reminiscences.

AFRICA.

South Africa.

'Das Kapland, insonderheit Das Reich der Kapflora das Waldgebiet und die Karroo, pflanzengeographich dargestellt von Dr. Rudolph Marloth. Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia," 1898–1899. II. Band, 3 Theil. 28 *Plates*, 8 *Maps, and* 192 *Illustrations in text.* Jena: Gustav Fisher. 1908.

It is not apparent at first how a plant-geographical survey of South Africa can be grafted on a German deep-sea exploration. Whatever the connection, however, the result is highly satisfactory. For the first time, we now have a comprehensive and systematic account of the vegetation—and largely of the regional geography—of this part of the world. Owing to its exhaustive and modern treatment, as well as to the magnificent style of its production, to its illustrations of unsurpassed excellence, this monograph will long remain the standard work of its kind on South Africa, and it is highly desirable that a translation into English should be undertaken at an early date.

In the physiographic introduction which duly constitutes the first part of this important study, we single out an interesting division into climatic provinces:

I. Regions with marked winter rains.
   1. South-west province.
   2. Little Namaland and Western Karroo.
   3. West coast—almost rainless; temperature uniform.

II. Regions with fairly regular precipitation throughout the year.
   4. South coast from Cape Agulhas to East London—abundant rainfall and fairly uniform temperature.
   5. Little Karroo—scanty rainfall, with minima under 10 inches.

III. Regions of dry winters, especially in July.

6. Great Karroo—minima of rainfall under 10 inches. (*a*) West, autumn rains prevalent. (*b*) East, summer rains prevalent.
7. Eastern grasslands—summer rains prevalent; minima between 10 and 20 inches.
8. North-eastern grasslands—rainfall as in Karroo; cold winter.
9. Roggeveld and Nieuwveld—rainfall very irregular, frequently lacking; cold winters; frequent frosts and snow.
10. South Kalahari—rain in summer and autumn, but scanty; hot summers; cold winter nights.

This classification may appear somewhat artificial and theoretical, but could easily be brought into conformity with the phytogeographical division which should largely be an expression of it.

A primary division is established between the extreme south-west and south, as constituting the domain of the Cape flora, and the rest of the land. The Cape region is stated to recede before the vegetation of the drier interior, and to split, on its margins, into insulated areas, mostly mountain ridges. It is sharply delimited on the whole by ridges and geological formations. The vegetation falls into four altitudinal belts. A broken and irregular strip of coast and lowlands includes the strand and dune formations, among which are remarkable bushlands and shrubby heaths, recalling the Brazilian "Restingas." *Acacia Cyclops*, introduced from Australia, has spread abundantly and materially altered the original aspect of this landscape. Characteristic also of this coast strip are the numerous representatives of the sedge-like order of *Restionaceæ* which, together with shrubs of myrtle aspect, form well-defined vegetation units on live sands resting on clay or hard pan.

The hills and piedmonts support the typical evergreen hard-leaf scrub, not distinguishable from the Mediterranean *Maquis*. Along with these occur hill heaths akin to the *Garigues*. These may be taken to typify the Cape vegetation and, in the author's opinion, probably to replace destroyed woodlands as in the Mediterranean and much of the Californian chaparral.

With increased rainfall, clouds and mists, the upper mountain belt, in the shape of insulated areas, though largely composed of the same genera as the former, offers, besides the rock heaths and mountain heaths, mountain swamps, the aspect of the whole suggesting rather the heaths of the plains than the *Maquis*. To this zone also belongs the Cape cypress or *Widdringtonia*, so much like the Monterey cypress, which occurs only on the northern ridges of Cederbergen about 2700 feet, mostly in inaccessible situations. This is all that remains of once extensive forests, corresponding to the mountain forests of California. An alpine or pseudo-alpine vegetation crowns the ridges.

Another vestige of the splendour of the Cape flora is the forest of Knysna. This probably extended much farther east and west, and linked with the Cape woodlands. The Knysna forests seem to stand half-way between the Mediterranean woods and luxuriant subtropical rain forests. In fact, both types appear in the illustrations. For practical purposes, however, the rich mixture of tree-species, the evergreen, glossy foliage, with lianas and epiphytes, would classify the South African forests along with the subtropical evergreen forests, with a close relationship with the south-east Australian forests.

Beyond the Cape region extend the southernmost territories of the old African flora. The main divisions of this vast area are the grasslands, the central region, and the west coast.

By grasslands—to which the name steppe can only be partly applied—are meant the areas the character of which is given by grasses, not necessarily in close

and exclusive swards, but indeed often scattered and interspersed with trees and bushes.

The *Boschveld*, the first subdivision, offers the same park landscape as East Africa, closely allied in ecology, aspect and flora. The Boschveld proper begins 100 miles or so north of Pretoria. Its trees are largely winter-bare and varied in nature.

The *Kalahari* is related in physiognomy and physiology to Bechuanaland, the Orange river, and the Transvaal. Nowhere plantless, except in the vleys and dry pans, it sometimes exhibits a good tree and shrub growth. Large plains occur, more or less scantily clad with toa-grass—a kind of Aristida—which certainly recall the high Algerian alfa plateaux. The average rainfall oscillates round 4 inches, and there may be for a few weeks a nice sward of fresh grass in favourable years. Scattered succulents clothe the stony hills.

The *Hoogveld* of upper Orangia and the Vaal—large plains, higher still than the Roggeveld and ranging from 4000 to 5500 feet—is a dreary, treeless, and shrubless grassland. Not a pebble, not a shrub, breaks the monotony of the endless plateaux, corresponding in every respect to the Asiatic steppes or the North American prairies.

In contrast, *Cafraria* exhibits a highly interesting variety of vegetation types: Thickets of grey, bushy euphorbias studded with tall aloes; denser still and impassable thorny scrubs, 9 to 12 feet high, containing a diversity of shrubs; the *speckboom*, profusely represented in the plains; stony hills strewn with succulents and aloes. Towards the east, the country passes into grassy park landscape interspersed with scrubs and tracts of woodlands in the valleys.

The *South-Eastern Coastal* strip, up to 1500 feet, is truly sub-tropical and of great fertility. Bananas, pine-apples, cane, mango, and tea can be grown here.

The Central Province is really a semi-desert of succulents and dwarf shrubs scattered over a stony ground. A distinction is made between the Karroos proper and the Karroo-highlands, mainly based on the relative prevalence of the two chief constituents of the landscape, succulents and dwarf bushes.

Dr. Marloth gives a clear definition of the *Karroos*, which he appropriately thinks ought to enter into the phytogeographic nomenclature as connoting a precise type of landscape, namely, a steppe passing or passed into semi-desert, the vegetation consisting almost wholly of succulents and dwarf bushes meagrely spread over the bare ground. The dry river-beds are marked with growths of *Acacia horrida* and Karreeboom (*Rhus biminalis*). Where social grass begins, the Karroos end. The very scanty rainfall may reach minima of 1 inch. The writer separates the Great Karroo, the somewhat rainier Little Karroo, the Karroo-highlands (Nieuwveld and Roggeveld), and the Little Namaland passing to pure desert.

We thus possess, after many attempts, at once a clear and concrete analysis and definition, and a co-ordinate systematization of geographical units based on considerations of vegetation, climate, and soil. A careful study of the work leaves, however, the impression that more might be done towards condensing and synthetizing the various units of the landscape.

An important contribution is here made to the problem of floral affinities and the origin of the South African flora. After an admirably clear statement of the historic and actual state of the question, the writer, reviewing the somewhat remote relationships with the surrounding land groups, Madagascar, St. Helena, the Tristan da Cunha group, Fuegia, South America, and Australia, studies the geological evidence. He concludes that there is no doubt that vast changes in the distribution of land masses took place in the Austral regions, in Mesozoic and early Tertiary times. Minor changes followed, probably restricted to South Africa, all resulting

in important climatic changes. A glacial period intervened in post-Tertiary times, producing a rainy or pluvial period.

But Dr. Marloth opines that a vast range of species and genera may have spread between remote lands by the same ways and means as are available to-day. The same may have taken place at earlier periods. He therefore suggests that these immigrants may have been the starting-points and nuclei of new genera and species. That the parent and linking species have disappeared, leaving the subsequent local offshoots insulated, is, in his opinion, no indication of a formerly closer connection between the lands of origin. But the writer readily acknowledges that not all the floristic problems can be solved in this manner.

M. H.

GENERAL.

Bibliography.

(*a*) 'Subject-Index of the London Library.' By C. T. Hagberg Wright. London: Williams & Norgate. 1909.

It was a huge task that was undertaken when, in 1903, mainly at the instance of the late Sir Leslie Stephen, it was decided to begin the preparation of a subject-index to the 220,000 odd volumes of the London Library; and that such a task has been successfully completed in less than five years since the actual work was begun is a striking testimony to the zeal and industry applied to its execution by Dr. Hagberg Wright and his coadjutors.

The need for such guides to the ever-growing volume of literature is one which yearly makes itself more and more felt, and the character of the London Library, as one in which every effort has been made to exercise an expert selection of the standard books on all subjects, makes a subject-index to its contents of unusual value. As regards the general plan, it was no doubt a wise decision to be content with a purely alphabetical arrangement of headings, for however great may be the advantages of a more systematic grouping of subjects, the labour involved by the adoption of such a system would probably have delayed publication indefinitely. And the disadvantages of the dictionary system have certainly been reduced to a minimum, not only by copious cross-references in the body of the work, but by a conspectus of headings classified by subjects, which is printed at the end. With these aids, although a good deal of search may be required to find all the books on a subject or group of subjects, the inquirer will probably be rewarded with success in the end. The elaborate system of abbreviations adopted will no doubt prove a difficulty to one using the index for the first time, but the amount of compression thus secured, by which alone the inclusion of the whole in a single volume has been possible, certainly outweighs any disadvantages on this score.

From the point of view of the geographer, a combined regional and subject classification of literature is no doubt the most valuable of all, but he will none the less find the index distinctly serviceable. When his search is for the literature on any one place, or on a country as a whole, he will meet with little difficulty. Thus all the most important books on Rome will be found under that heading. In the case of the literature on a less well-defined region, a considerable amount of search may be necessary, and all the more from the evident desire on the part of the compiler to reduce the main headings by decentralization as far as possible. Thus a work like Pike's 'Travels' appears neither under "United States" nor under "North America," but under the various special districts covered by it, viz. "Louisiana," "Mississippi," and "Mexico." On the other hand, by looking up "North America," in the conspectus of headings, the inquirer will find a list of all the principal headings under which entries relating to North America are distributed.

The Fellows' R.G.S. Antarctic Fund

Private & Confidential List of April 20.
For Lt.-Gen. I. Hills-Jones, V.C., read Lt.-Gen. Sir James Hills-Jones, V.C.

The following Subscriptions to the Fund have been received between April 20 and May 25, in addition to the £976 5s. 6d. already acknowledged :—

	£	s.	d.
Colonel J. A. Burdon	2	10	0
Ambrose P. Boyson, Esq.	2	10	0
Rear-Admi. T. P. Walker	2	10	0
S. F. Hulton, Esq.	5	0	0
T. L. Evans, Esq.	2	10	0
Major E. C. Hawkshaw	1	1	0
E. Gerald J. Moyna, Esq.	5	0	0
Emil Teichmann, Esq.	10	0	0
Lady Russell	10	0	0
Falconer L. Wallace, Esq.	5	5	0
Sir Allen Young	25	0	0
Col. Sir Richard Temple, Bart.	2	10	0
Richard Cooke, Esq.	5	0	0
Alfred Clay, Esq.	2	10	0
Admi.'Fleet Sir F. Richards	5	0	0
William Hancock, Esq.	2	10	0
Heber Mardon, Esq.	2	10	0
Colonel W. B. Capper	1	1	0
Augustus White, Esq.	2	10	0
John Bolton, Esq.	1	0	0
William King, Esq	2	10	0
Major J. Beaton	5	0	0
Charles Heape, Esq.	2	10	0
Francis Druce, Esq.	2	10	0
T. A. Routh, Esq.	2	10	0
Henry W. Bush, Esq.	2	10	0
Major O. C. Williamson Oswald	2	10	0
Capt W. Meyer-Griffith	1	1	0
Pestonjee Dinshawfu Khan	5	0	0
H. Richmond Palmer, Esq	1	1	0
Richard Kalisch, Esq.	1	1	0
Edward Stanford, Esq	10	0	0
C. H. J. L. Beadnell, Esq.	2	10	0
F. W Lawrence, Esq.	5	0	0
Harry Coleman, Esq	2	10	0
S Brocklehurst, Esq	5	0	0
Lt.-Col. Sir H. Trotter	5	0	0
J. W. Brooks, Esq.	1	1	0

In order that Subscribers might be informed, in the June issue of the Journal, of the disposal of their contributions—the Fund has been closed this day.

Any further Subscriptions which may be received will be acknowledged, and paid in to the Secretary of the British Antarctic Expedition, 38 Victoria Street, Westminster, S.W.

The letter of Appeal was sent to 3272 Fellows resident in the United Kingdom. The number of Subscribers to the Fund has been 212, but letters have been received from 20 Fellows, saying that they had already contributed to Captain Scott's Expedition through other channels.

	£	s.	d.
To printing letter of Appeal and Subscription Lists for April, May, and June	10	1	6
„ Postage of Appeal and of acknowledgments since April 20	13	15	0
„ Balance for Captain Scott's Expedition	1107	2	0
	£1130	18	6

	£	s.	d.
To Subscriptions from Fellows, etc.	1130	18	6
	£1130	18	6

May 25, 1910.

ALBERT MARKHAM.
LEWIS BEAUMONT.

Again, travels over any large part of the world will be found grouped under "Voyages and Travels." The index is intended to be used in conjunction with the author catalogue issued in 1903, and frequent references to this are given. Thus in many cases reference is made for biographies to their subjects under the author alphabet.

Taken as a whole, the index (in the preparation of which each book was examined individually) seems surprisingly free from mistakes, and bears such clear evidence of care in its compilation that it would be ungenerous to dwell on the slight inconsistencies which it was inevitable should here and there be noticeable.

(*b*) 'A Catalogue of the Manuscripts in the Library of the Hunterian Museum in the University of Glasgow.' Planned and begun by the late John Young, continued and completed by P. Henderson Aitken. Glasgow: J. Maclehose & Sons 1908.

This catalogue of the manuscripts brought together by Dr. William Hunter in the eighteenth century has been compiled and edited with the most minute attention to detail, though no attempt has been made to classify the material. The subjects of the manuscripts range over a wide field, religious, historical, medical, orientalia, etc., though the largest class is perhaps the medical. A few only of the items are of geographical interest, but of these two or three deserve some attention. One is a memoir by Arthur Dobbs (known as the bitter foe of the Hudson's Bay Company and as a champion of the further prosecution of the search for the North-West Passage), which does not seem to have been published, or to be generally known to students of early voyages. It begins with an epistle dedicatory to Frederick, Prince of Wales, and seems to have been written about 1730, and to have represented the earliest step taken by Dobbs to obtain support for his project. It contains a chart by Thornton of the region between Newfoundland and Hudson bay. Another important item is a Portolano by Baptista Agnese, one of the charts in which bears the date September 25, 1542. This atlas does not seem to have found a place in the lists of Agnese's works recognized undoubtedly as such by writers on early cartography. Harrisse, in his 'Discovery of America,' includes, though with a query, an atlas in Glasgow University Library among Agnese's productions which are "neither signed nor dated," and this may possibly be in reference to the copy now under consideration, which appears to contain twelve charts besides preliminary diagrams. One of the maps is described in the catalogue as "a circular map of the world on Mercator's projection," the meaning of which is not very clear (particularly in view of the date), any more than is the reason for the author's description as "a Spaniard of Valencia." The collection also includes manuscripts of Marco Polo and Friar Oderic (Latin, fourteenth century); of G. Boccacio's Gazetteer (1432); of John Hardyng's 'Itinerary of Scotland' (fifteenth century); an Arabic Treatise by an unknown author on the 'Rising of the Nile'; and one or two others with some geographical bearing.

Educational Books.

'The Scholar's Book of Travel.' Four parts. I. 'The British Isles' (pp. viii., 197). II. 'Europe' (pp. viii., 198). III. 'Other Lands' (pp. viii., 200). IV. 'The British Empire' (pp. viii., 200). (London: Philip. *N.d. Maps and Illustrations.* 1*s.* 3*d.* each part.) These volumes consist of extracts from well-known writers dealing with topographical subjects. The range of selection is wide; both prose writers and poets are laid under contribution, and include such names as Kingsley, Wordsworth, Darwin, Ruskin, Lytton, and Dickens, besides a number of the great explorers. The merits of this system of geographical teaching are

obvious; if carefully selected, as these are, the extracts are certain to induce a taste for further reading in the works of the authors cited. These volumes should be valuable in providing the interest which is still often lacking in geography lessons, though we find in the editorial preface a somewhat sweeping condemnation of other systems of geographical teaching. The series might have been improved by fuller annotation. At present it is left largely to the teacher to remove any false impressions that might be created by statements of the earlier writers which are no longer strictly true, and to explain such points as their frequently old-fashioned spelling of place-names. We do not always follow the arrangement of the volumes. In Part I. ('British Isles') there are a number of "readings in physical geography" drawn from South America and other parts.

'A Systematic Geography of Europe.' By G. W. Webb. (London: Methuen. 1910. Pp. viii., 96. *Maps.* 1*s.*) This is a straightforward work, somewhat, it may be said, of the old school. It deals with each country in succession, noting the mountains and rivers, chief towns, products, history (very briefly), and other details, in an orderly arrangement, without attempting to draw geographical inferences or offer geographical reasoning. One observes a certain disability to print diacritical signs in place-names, as in Scandinavian and Balkan forms.

'The Oxford Geographies.' Elementary. Vol. 4. 'Asia' (pp. 128). Vol. 7. 'The British Isles' (pp. 192). By F. D. Herbertson. (Oxford: Clarendon Press. *Maps and Illustrations.*) These are further examples of the authoress' style in writing elementary books—simple and direct, without a word that could be unintelligible to the most backward pupils, and appealing constantly to their powers of reasoning from geographical premisses. Ample use is made of photographs Exercises and questions are provided at the end of the chapters. It might be suggested that some of the maps (*e.g.* that of the Pennine district) are somewhat highly elaborated for this class of work.

'Typical School Journeys.' By G. G. Lewis. (London: Pitman. *N.d.* Pp. 140. *Illustrations.* 1*s.* 6*d.*) An interesting little volume, describing, and illustrating by numerous photographs, the methods of giving children instruction in geographical and nature study in the field. It should be very useful to teachers who contemplate such work, especially in London schools, for the various uses to which Hampstead Heath can be put occupy a large part of the work, and those longer journeys which are described are mostly day excursions from the metropolis.

'Practical Geography.' By J. and W. Miller. (London: Bell. 1909. Pp. vii., 116. *Maps and Diagrams.* 2*s.*) "Practical Geography" is a slightly misleading title, as the epithet has been used by some other authors as a kind of general appreciation of their own work. In this case it refers simply to map-work in its various branches. Not only hints on map-reading and measurement on maps are furnished, but also the elements of surveying, worked out with good judgment, so far as they can be, without presupposing any considerable knowledge of mathematics. In its particular line the book should fill a want.

'Manual of Physical Geography.' By F. V. Emerson. (New York: Macmillan. 1909. Pp. xviii., 291. *Diagrams.* $1.40 *net.*) This is a remarkable book. It is designed mainly for teachers' use, though it might serve advanced students who wished to realize the possible scope of examination questions. It consists entirely of questions: at a rough estimate it contains five or six thousand. They are cleverly devised; a group of them often suggest the answers one to another.

'A Physical and Economic Geography of the World.' By C. A. Wood. (London: Normal Press. *N.d.* Pp. 147, l., 214, 85, 53, 115, 42, iv., xvi., vi., iv., vi., iii. *Maps.* 4*s.* 6*d.*) The extraordinary pagination of this volume indicates its division and that of the index into parts dealing with the various continents and

great divisions, though otherwise any useful purpose is not obvious. The book is astonishingly full of facts, and contains an occasional statement which falls into another category, as that London as a port is accessible to the largest ships. Fulness and the reduction of style to a dull level of compression are the chief characteristics of the work. The simplicity of the maps and diagrams may have the advantages claimed for it, but does not condone poor draughtsmanship, frequently indifferent reproduction, and bad printing.

O. J. R. H.

Military Geography.

'An Introduction to Military Geography.' By Brigadier-General E. S. May, C.B., C.M.G. London: Hugh Rees. 1909. 8s. 6d. *net.*

This book is primarily intended for the use of officers, but will prove generally interesting to geographers, as it contains numerous illustrations of the geographical questions on which the issues of campaigns have often depended.

The author points out that no factor can be neglected which is likely to influence the movement of troops. In the war between Russia and Japan, the valley of the Liao river afforded an excellent example of the obstacles which can be presented by cultivated crops. He says, "In the valley, conditions more favourable to movement existed, but the immense crops of millet, which is planted in drills 2 feet apart, and grows to as much as 12 to 15 feet in height, obscure the view, obstruct evolutions, and act as a screen to the movements of troops. Further, by breaking off the stalks some 3 feet from the ground, an obstacle rendering the ground well-nigh impassable for troops can be created."

A knowledge of tides has on several well-known occasions contributed to success. Edward III. relieved his army from a critical position before Crecy by using information about a ford which could be passed at ebb tide.

The importance of a study of climate is emphasized with a view to the appreciation of those local conditions on which communication depends in countries where there are marked seasonal differences. The impassable quagmires into which the tracks degenerated in Manchuria after heavy rain are instances in point. The author deals very fully with European frontiers and their defence, and with canals and railways in Europe and elsewhere. Persia, the North-West Frontier of India, and Manchuria are dealt with in separate chapters.

The book is well illustrated by sketch-maps.

A. W. A.

THE MONTHLY RECORD.

EUROPE.

The Vegetation of Some Disused Quarries.—The above is the title of a reprint, from the *Bradford Scientific Journal*, of a paper by Mr. Samuel Margerison of Calverley, Yorkshire. The subject dealt with is the conquest of new ground by plants, and the local variations of plant life according to soil, exposure, etc., within a small circumscribed area; and it is treated in a manner which should throw light upon the similar but greater variations of plant phenomena apparent when wider areas are studied. The quarries to which special attention is given are sandstone workings, and are situated in the Calverley woods, in the valley of the Aire, at no great distance from Leeds and Bradford. The general aspect of the quarries is towards the north, so that they are exposed to the full force of the winds blowing from Rumbold's Moor 7 miles to the north-west, but there are portions

of the quarries sloping to all points of the compass with different degrees of shade and shelter. The whole succession of plants that has invaded these old disused quarries from the early pioneer vegetation to the recent is discussed in detail, and the paper contains many interesting photographs illustrating various phenomena relating to the vegetation. In the oldest quarry worked nearly one hundred years ago the vegetation has to a great extent returned to a woodland character of birch and sycamore, whilst various herbaceous plants like the wood-hyacinth are already established in the abundant humus. The geological strata exposed at Calverley all belong to the Carboniferous series, and contain various grits, shales, flagstones, etc. Ling grows very abundantly on the sandstone spots, but is almost entirely absent from the shaly tracts, which are instead covered with hair-grass (similarly, but on a larger scale, we find that chalk or limestone localities are characterised by beech and ash trees, sandstone ones by pine, and clay districts by oak and elm). The growth of the ling exhibits important structural variations with different degrees of shelter from wind. On the top of a dry tip exposed to the wind from the moors, some ling plants have taken the squat cushion-like form of Alpine plants, and have more hairy leaves than other plants a few yards away on the leeward side of the hill some 5 or 6 feet lower down. In the woods surrounding the quarries the dominant plants are: oak, birch, mountain ash, holly, bracken (with male fern, lady-fern, buckler fern, soft grass, and hair-grass), and wood hyacinth. The oaks, owing to the somewhat polluted atmosphere consequent upon the industries of the West Riding of Yorkshire, are failing somewhat rapidly. To the writer of this note on Mr. Margerison's paper it has always seemed most remarkable that the oak indigenous to the British soil is, with the exception perhaps of the conifer tribe, the very first to succumb to the injurious effects of sulphurous and carbonaceous impurities in the atmosphere arising from the combustion of coal, whereas imported species like the plane are good smoke resisters. Not only does the oak fail in the great industrial areas of the north and midlands of England, but also in the comparatively pure atmosphere of inner London, the parks of which are thus deprived of one of the most essential and striking features of normal English botanical landscape. The British oak, in fact, with all its strength and rugged grandeur, has many points of weakness, and does not endure the salt spray of the sea so well as many other trees, with the consequence that it rarely fringes the seashore. Mr. Margerison's study, if continued, might form the nucleus of much interesting investigation, for while nothing remains to be added to our knowledge of the general geography of England, it is perhaps not going too far to say that as regards the more minute surface details a critical comparative study of differences of topography, climate, vegetation, etc., in the different shires would reveal results of great interest. Both Northumberland and Cornwall, for example, have a prevailing type of bleak moorland scenery, and one would like to see the two counties studied and *compared* in close detail.

Local Winds in the South of France.—The *Bulletin de la Société Languedocienne de Géographie* (Tome xxxii., Deuxième trimestre, 1909) contains an article by E. de Martonne on the peculiarities of a wind known in the provinces of Aquitaine and Languedoc under the name of *vent d'autan* or *vent marin*. Observations refer, up to the present, only to the months of October, November, and December, 1908, so that the conclusions drawn therefrom must not necessarily be extended to the whole year. The wind is an east wind, and has different characters locally, being called *marin* where it is humid, cool, and of comparatively little violence, and *autan* where it is relatively hot and violent. Like the *mistral*, the autan is especially known for its destructive violence, but the force is very variable in both time and space. Thus, on the one hand, even during the most violent winds there

are moments when the wind drops to a calm, and, on the other hand, places only a mile or so apart may be affected very differently as regards the violence. At Labrespy, for instance, situated in the zone of the most violent autan winds, high velocities are rarely registered, but 2 kilometres away is a road where carriages are liable to be precipitated into the valley, and where pedestrians have to lie flat on the ground. The autan, while dependent on the distribution of atmospheric pressure for its occurrence, evidently owes its violence to topographical circumstances, and from the great local differences in its strength may be appropriately designated a *topographical* wind. The surface inequalities retard or accelerate the air-movement, and there are spots in the valleys where the wind is described by the inhabitants as dropping down from the heights like a cataract. The autan is doubtless of the nature of the föhn of the Alps, and the *marin* is converted into the *autan* in Haut-Languedoc by topographical features. The marin is apt to bring falls of snow in winter, which are much dreaded by the foresters of the Montagne Noire. The snow is so thick and heavy that the over-laden branches of the trees are often broken, and the same effect is produced by the rime-depositing fogs which are common in winter. Replanting is rendered difficult, and the continued extension of heathland over the little-elevated crests of the Montagne Noire is perhaps partly attributable to this cause.

The Expansion of Vienna.—An important contribution to the elucidation of this subject is furnished by Dr. H. Hassinger in an article giving evidence of much research in the *Mitteilungen d. K.-K. Geogr. Gesellschaft in Wien* (vol. 53, No. 1). The often gross divergence, it is pointed out, between the official and the real city boundaries, and the disparities in value of the official figures of areas and populations, impair and even stultify a correct estimate of them. The extension, *e.g.*, of the jurisdiction of Vienna in 1698 excluded non-civic suburbs, free lands, and seignorial estates. In 1890 and 1904, Vienna incorporated suburbs and outlying places. In consideration of the building of the Danube-Oder canal and the laying out of a girdle of forest and meadow round the city, the civic administration has now secured large areas in Marchfeld. Dr. Hassinger has therefore set himself the task of finding a method for determining the actual boundary of a town, such as will be applicable, not only to Vienna, but to cities generally, whereby their actual areas and populations may be ascertained. The real boundary of a city is taken to be the boundary of the ground actually occupied by it, without regard to its character as an economic factor or to its sphere of influence, political, spiritual, and commercial. The true city boundary coincides with the boundary within which the city population lives throughout the year, and is determined by the maximum time it can afford to spend on the journey between the place of residence and the place of business. This boundary may be regarded as fixed by a 60-min. isochrone—a line connecting all points attainable, by the means of locomotion available, in one hour from the city's centre. The real centre, as distinct from the historic and cultural, geometric, and other centres, is determined to be Stock-i.-Eisen Platz. Such isochronic boundary is, of course, far from circular, shooting out long tongues, to a maximum distance of 14 miles, along the main railway lines, and contracting itself especially on the east; the area enclosed having a mean radius of 4·7 miles. All outside the 60-min. isochrone are sparse *Vororte* with isochrones of 60 min. to 100 min. Within the 60 min., a 40-min. isochrone is also drawn. The extension of Vienna from the old "Inner City" into the modern "Centre" and "Precincts" offers a very interesting type of the growth of cities generally. Only a few figures can here be quoted in illustration of the importance of locomotion machinery as a civic factor. The introduction of the omnibus coincides with the beginning of the transformation of Vienna into the modern city. Early in

the nineteenth century the burgher classes drove to a summer retreat in a village outside the city lines. Soon there was an hourly service to Hietzing and Döbling. In 1835, sixty stage coaches ran in every direction, and "the lines," said Schmidt, "were no longer the residential boundaries." In 1838, the Northern Railway was opened to Wagram; in 1841, the Wien-Gloggnitzer; in 1858, the Elizabeth Western Railway, and since 1870 the Franz-Josef and North-Western Railways. The first horse-tramway was laid in 1866 to Dornbach. In the eighties, steam tram-lines were opened. In 1897 began the transformation of horse and steam-tram into electric lines. Growing slowly in the eighteenth century, the population in 1815 reached only 250,000; in 1820, 260,000; in 1830, 317,000; 1840, 356,000; 1850, 431,000; in 1869, 607,000 inside, and 210,000 outside the lines. In thirty years the population more than doubled. In 1880, the first million was exceeded; in 1908, it is estimated, the second million.

Morphology and Glacial Features of the Eastern Carpathians.—In his investigations into the mountain forms of the Eastern Carpathians in the Austrian Crownland of Galicia, Eugen von Romer, of Lemberg, shows how valuable is orometry as a factor applied to the elucidation of the origin of mountain forms ('Morphometrische Studien über die Ost-Karpatischen Gebirgsformen,' *Kosmos*, vol. 34, Lemberg, 1909. In Polish with German *résumé*). The length of the isohypses (L) was measured, and, making use of the Finsterwalder-Peucker formula for the mean inclination (I), was brought into relation to the area of the projection in a plane (A). (Tan $I = \frac{h \cdot L}{A}$, in which h denotes the uniform distance apart of the isohypses.) The older forms, *e.g.* those of the old peneplain, are indicated in the longitudinal profiles with their small mean inclinations varying from 4° to 8°. Those forms, on the other hand, which, after the pre-pleistocene upheaval, were carved out anew by erosion, are characterized by the relative steepness, which finds expression in mean inclinations of the slopes in the transverse profiles amounting to 20° to 25°. The orometric investigation leads, further, to interesting results in respect of the asymmetry of the ridges and summits. This asymmetry is seen to the north of the watershed (*e.g.* between the Dniester and the Pruth on one side and the Theiss on the other) in steeper northern, to the south of the watershed in steeper southern, slopes. The degree of inequality in the slopes increases with the approximation to the edge of the Carpathians. The summits, on the other hand, are asymmetric only on the inner highest elevations, which display a steeper drop to the north. The asymmetrical build of the mountain-ridges is, in Romer's opinion, due to the erosion which first set in after the elevation referred to, and it may thus be ultimately traced back to tectonic causes. This period of erosion must, however, have preceded the ice age, which, coming later, was the special cause of the asymmetry of the summits. As to the character of the ice age in the Eastern Carpathians, the following conclusions are drawn from the distribution of the angles of inclination: (1) On the bordering ridges, as compared with present-day conditions, there was increased precipitation on the northern slopes; (2) on the inner ridges there was little difference of climate as compared with that of to-day; (3) the high ridges of the watershed bore fields of *névé* on the slopes with a northerly aspect—Sywula, 5960 feet, Bratkowska, 5880 feet; (4) Swidowiec, 6180 feet, bore névé on the southern, glaciers on the northern, slopes; (5) the Czarnahora (reaching 6750 feet in the Howerla) was glaciated on both slopes. As particularly characteristic of ice-age glaciation, Romer lays stress on the coincidence of the maximum of the horizontal development of the isohypses with the minimum inclination of the slope at the level of the then existing snow-line.

ASIA.

Surveying in the Shan States and Mekong Basin.—A narrative report by Captain R. H. Phillimore, R.E., on Surveys in the Shan States, included in the 'Extracts from Narrative Reports of Officers of the Survey of India for 1907–08,' gives some interesting details regarding the Mekong river, which formed the eastern limit of the survey work during the season under review. Under the Franco-British Treaty of 1896 the Mekong is the boundary between French and British territory. The Shan name is Nam Hkawng, or Me Hkawng, the latter having been accepted for popular use in the distorted English form Mekong. The river is full of rapids, and the highest point to which steamers have ever been brought is Tang Aw, lat. 20° 40′, where, in 1893, the French built a small fort on the left bank. There is now a regular steamer service up to Ban Hwe-sai, some 60 miles below Tang Aw. The Laos bring large country boats as far as Tang Aw, where goods are landed and shipped, being conveyed to and from the Keng Tung state to the west. The river is in flood from about August to October. During the dry season it falls about 30 or 40 feet, while its width contracts to less than 300 yards. The defile of the Mekong is not so striking as that of the Salwen in the same latitude, the hills that immediately enclose it not running up so steeply or to such great heights; but it is a very fine river, and is distinctly impressive at low water, swirling down between walls of rock that rise 30 feet or so above the water-level. There are several villages along both banks of the river, and ferries at frequent intervals, while boats, both dug-outs and rafts, are used for communication up and down the river between village and village. During the dry season mule and bullock caravans find an excellent route along the bed of the river, this forming quite a highway between Keng-Lap and Hsop Yawng, where the caravans turn up towards Mong Yawng. The French have toll posts at most of the ferries, but no toll is collected on the British side. The height of the river-bed above mean sea-level is 1505 feet at Keng Kum, lat. 21° 6′, and 1199 feet at Hsop Hok, lat. 20° 20′, where it leaves British territory. The Mong Yawng plain in lat. 21° 10′, already referred to, is about 32 square miles in area, with a general height of 1800 feet above sea-level; it is covered with rice cultivation, and is thickly cultivated. The city itself is neither imposing nor important; the district, however, is wealthy, and in former days was independent of Keng Tung. There is a pagoda of some renown on a low hill to the south-west of the plain, 6 miles from the city. Its construction is of very early date, and it is similar in design to the famous Angkor ruins in Cambodia. It is held in great veneration throughout Keng Tung, and is said to have been built over seven hairs of the Buddha, and to have been visited by the great king Asoka.

Explorations in the Tian Shan and in Dzungaria.—Dr. Paul Gröber, the companion of Dr. Merzbacher on his second journey of exploration to the Tian Shan (*Journal*, vol. 33, p. 278), has, since separating from the latter, carried out further investigations in the range on his own account. A brief account of these is given in the third number of *Petermanns Mitteilungen* for 1910. From Kulja he went south in October, 1908, crossing the Temurlik-tau and the central range of the Tian Shan (the latter by the Musart pass), and examining certain great valleys, not previously explored, to the west of the Musart river. Proceeding south-west to Aksu, he devoted some time to the exploration of the ranges south and west of Ush Turfan, separated from the main Tian Shan by the great longitudinal valley of the Kok-Shal. In parts his routes coincided with those of Dr. Stein, Dr. Sven Hedin, and Dr. Merzbacher; but they were also in great part new, and disclosed many inaccuracies in existing maps, *e.g.* the Russian 40-verst sheet of this region,

Dr. Gröber also acquired a general idea of its main geological features. He returned to Europe in the spring of 1909 *viâ* Kashgar, Osh, and Marghilan. Another journey of geological research was carried out in 1909 by M. Obrucheff, in the mountains of Dzungaria, to which he had already devoted more than one summer's work (*Journal*, vol. 28, p. 180; vol. 29, p. 457; vol. 31, p. 673). A short *résumé* of the results appeared in the first number of *Petermanns Mitteilungen* for 1910. The special object was to carry out a more careful examination than had before been possible of the Barlik, Maili, and Western Jair ranges, forming the eastern continuation of the Alatau; and it proved that these, like other ranges of this region, form in the main high plateaus 3500 to 6500 feet in altitude, with fairly level surface covered with alpine meadows, and falling in steep and deeply cleft escarpments.

American Magnetic Research in China.—Among the expeditions for magnetic research sent out by the Carnegie Institution of Washington (*Journal*, vol. 34, p. 92), that under Mr. D. C. Sowers, which set out in November, 1908, had the Chinese Empire as its field of work. According to a note in *Science* for February 11, this expedition returned to Washington last December, having successfully accomplished its mission. The route followed was the great northern trade-route, passing out of China proper in the north-west, and thence crossing the Gobi to Urumtsi. Thence the party skirted the Takla-Makan desert, reaching Kashgar on July 28, 1909, and Leh in September. Connection was made at Dehra Dun with the Magnetic Survey of India.

Completion of the French Yunnan Railway.—The completion of this railway to Yunnan-fu was announced early in January. For an instructive discussion of its economic possibilities, readers may be referred to a paper by Commandant D'Ollone in the *Quinzaine Coloniale* (December 10, 1909), reproduced in the *Revue Française* for February, 1910.

AFRICA.

The Atlas of Morocco.—In reporting the results of further geological researches in Morocco, M. Gentil (*ante*, p. 196) discusses the question of the nature and western limit of the great Atlas of Morocco, his latest journeys having taken him to the region between the Tensift and the Sus, which embraces the westernmost spurs of that range. From his explorations in 1905 (*Journal*, vol. 26, p. 333), M. Gentil had become of the opinion that instead of terminating (as seemed indicated by the explorations of Joseph Thomson) nearly 60 miles from the sea, in the elevated region of the Ida or Mahmud, the Great Atlas, as determined by geological structure, really continued west to the shores of the Atlantic. In his latest journey he has found full confirmation of this view, being able to establish the fact that the axes of the main folds plunge downwards as they approach the sea, while they are also continuous with those of the more elevated part of the range inland. This downward inclination is markedly observable only in the case of the spurs running out to Capes Rir and Agadir, and this may help to determine the true limits, transversely, of the Great Atlas. The tertiary chain of the Great Atlas of Morocco shows a decided tendency to an overthrust northward, in the direction of its foreland, the meseta or platform of Morocco, a fact which recalls, though on a far smaller scale, the conditions observable in the Alps.

The International Frontiers in the Kivu-Ruwenzori Region.—It was announced on May 14 that the long-disputed frontiers of British and German East Africa with the Belgian Congo were finally fixed by a protocol signed by the representatives of the three Powers at Brussels on that day. According to a preliminary statement, Germany obtains the desired frontier of the Rusizi and Lake Kivu, but the island of Kwijwi in the latter is assigned to Belgium. From the north end of

Kivu the frontier will run across Mount Karisimbi to the summit of Mount Sabinyo, which will be the meeting-point of the three territories. The Uganda-Congo frontier will run past Mount Nkabwa and along the Ishasha river* to Lake Edward, and, crossing the latter, will follow the Lubilika river to its source, running thence to the Margherita peak, and thus leaving a portion of the Ruwenzori range to Belgium. Descending the Lamia and Semliki to Lake Albert, it will follow the median line of the latter to a point opposite Mahagi, Belgium thus gaining the whole western shore of the lake.

The Franco-Liberian Frontier.—In the *Journal* for January, 1908, we gave a provisional sketch of this frontier as defined in the Franco-Liberian agreement of 1907, and have since alluded to the work of the joint commission sent out to make a survey along the line of the frontier. This task was completed last year, and a provisional protocol embodying the final suggestions for the precise line to be adopted was signed by the heads of the two commissions, while the definitive agreement between the two governments is expected to be concluded at an early date. Some account of the work of the commission was given before the Paris Geographical Society in November last by M. Richaud, and a concise summary of the same appears in the April number of *L'Afrique Française*, accompanied by a map showing the boundary as finally proposed. The Commissioners were, on the French side, M. Richaud, with various officers under him, and on the Liberian, Commandant Naber and M. Moret, the former of whom was invalided home before the conclusion of the work. They were instructed to adopt natural topographical lines as far as possible, and to avoid separating villages belonging to one and the same tribe. The result is to introduce considerable modifications of the line sketched in 1907, all, it seems, to the advantage of France. Thus, in the northern section, between the Makona and the source of the Nuon (see sketch in vol. 31, p. 105), a wedge of French territory, formed by the Gerze country, is thrust southwards well beyond the 8th parallel. The work of the commission was rendered arduous both by the nature of the country and by the opposition of the natives, with whom hostilities took place in parts. A valuable map of the whole region traversed has been constructed since the return of the French commission to Paris. Like M. Chevalier (*Journal*, vol. 34, p. 342), the commission regards the Nuon, a section of which coincides with the boundary, as the headwaters of the Cestos, though, since the discovery of its separation from the system of the Cavalla, others have supposed it to be the headstream of the St. John. After separating from the French Commissioners on the upper Cavalla, M. Moret struck direct for the coast across the hitherto untraversed southern interior of Liberia. The route, which is described in the January number of *La Géographie*, led through continuous forest, in which supplies were with difficulty procurable.

Trade of Angola.—A Consular Report, by Mr. Mackie (No. 4391, Annual Series), on the trade of Angola province for 1908, records, *inter alia*, the employment of botanists for development of the rubber industry, the organization of a syndicate for promotion of cotton culture, and the exploitation on a hitherto unattempted scale of the navigable rivers. The clearance of obstructions on the Loje, 18½ miles from Ambriz, was nearing completion, offering immediate prospect of river traffic by barges of two tons burden for 62 miles, and by the end of the year, 130. On the clearance of the rapids at this point, the administrative centre would be shifted to Sanda, where, opening stores, commercial houses at Ambriz might establish trade with the natives of the coffee-growing district. It is further

* These names will be found in Major Bright's map (*Journal*, Vol. 34, p. 240). The Lubilika is the small river entering the lake at its most northern point.

proposed to utilize the upper Zambezi, Luena, Lungwe-Bungo, Kuando and affluents, Kwito, and Kubango. The Loanda railway, whose provisional terminus is now transferred to the Kuango, and its final destination to the Kasai, remains still suspended at Ambaka, 225 miles from the coast. The parallel Lobito railway, to terminate in the first instance at Katanga, was also suspended in 1908, not to be resumed before 1910. The area under cocoa cultivation at St. Thomé amounts to 600,000 acres. As to coffee, still the chief article of export from Angola, it is noted that millions of plants, thick as cresses in some places, occupy the shady mountainous belt running parallel with the coast at an altitude of 1600 to 2300 feet, from the river Kwanza northwards towards the lower Congo. The report also includes instructive details on the cattle, cocoa and coffee cultures, rubber, cotton, minerals, and shipping of Angola.

AMERICA.

Earthquake in Costa Rica.—News has been received that a violent earthquake has practically destroyed the town of Cartago, in Costa Rica. The principal shock was experienced at 6.50 on the evening of Wednesday, May 4. It was felt over a considerable part of Central America; but little damage was done except at Cartago, though it is reported that several villages on the railway between that town and the seaport of Limon have also suffered. Many buildings collapsed, involving great loss of life. In the earlier telegrams 500 people are said to have been buried in the ruins, but later despatches place the number at 1000. Fortunately, San Jose, the largest town and the capital of the state, has escaped serious injury, and many refugees have fled to it. The work of rescuing those who were imprisoned in the ruined houses has been actively carried on, though interrupted by numerous after-shocks. Telegraphic communication with Cartago was broken, but it seems certain that little damage has been done to the railway. The Peace Palace in Cartago, which was built from funds provided by Mr. Carnegie, is reported to be demolished. Cartago has a long record of similar catastrophies, having been damaged by earthquakes in 1723, 1803, 1825, 1841, 1851, and 1854. The earthquake of 1841 was of great violence. The town lies in one of the most active seismic belts of Central America. There are two volcanoes in the neighbourhood, Irazu (11,480 feet), with a large crater which is at present in a solfataric condition, and Poas (8895 feet), with a lake of hot water in the summit crater that often emits great clouds of steam. As no reports of volcanic activity at either of these centres have been published, it seems probable that this earthquake is not of volcanic origin, but, like those of Chili, is connected with the orogenic movements of the Central American cordillera.

AUSTRALASIA AND PACIFIC ISLANDS.

Dr. Lorentz's Ascent of the Snowy Range in Dutch New Guinea.—We referred in the March number to the successful ascent by Dr. Lorentz of the snowy range which has been for several years the principal objective of Dutch exploration in the south-west of New Guinea. Further details of this achievement, derived from Dutch sources, are given in the May number of *Petermanns Mitteilungen*, p. 258. Besides the leader, the expedition included Captain J. W. van Nouhuys, Lieut. D. Habbema, and Dr. van Römer, while the native following consisted chiefly of Kayans, one of the Dayak tribes of Borneo. After a preliminary reconnaissance, the expedition proceeded up the North river and established a base camp, at which the whole party was united on October 4, 1909. An advance was then made in detachments to the Hellwig range, where a dépôt was laid down, the journey being continued with a reduced force. Natives were encountered, and friendly relations established with them. On November 1 an altitude of nearly

11,000 feet was gained on the Wichmann range, in 4° 25′ S., and on November 5 the ascent of the main range was begun. The first attempt was abandoned at an elevation of 13,120 feet, but a renewed attempt on November 7 brought the explorers to the first snow, and at the same time abundant evidences were found of a former more extensive glaciation. On November 8 Lorentz and van Nouhuys reached the limit of perpetual show at 14,635 feet, the former climbing some 130 feet higher for the purpose of taking photographs. The increasing mist then made it necessary to turn back, when the leader met with an unfortunate accident, falling into a chasm nearly 200 feet deep, and injuring himself so severely as to be unable to continue the descent for some days, the first night being spent at an altitude of 14,350 feet in the teeth of a freezing wind. The smallness of the stock of provisions placed the party in a precarious position, but they were eventually saved by the arrival of relief from the camp below. Three of the natives had succumbed to want and cold, and the instruments, etc., had had to be abandoned. The result of the expedition is of importance as showing that the range has not merely an occasional covering of snow, but that there is permanent snow and glaciers. On the south side the latter reached an altitude of about 13,200 feet. The presence of ice at this exceptionally low altitude, almost on the equator, proves that the precipitation must be unusually great in this part of the island. Eocene limestone, such as occurs at sea-level in Triton bay, was found near the snow, and there were other evidences that great alterations of level have taken place since Tertiary times. The altitude of Wilhelmina peak, the highest point yet discovered in New Guinea, was fixed as about 15,580 feet.

POLAR REGIONS.

Ice in the Arctic Seas during 1909.—The annual report on the state of the Arctic ice issued by the Danish Meteorological Institute has lately appeared, dealing with the year 1909. As a whole, the state of the ice was unfavourable in the Barents sea and around Spitzbergen, and it was only during the last days of August that it was driven away from the northern shore of the latter by southerly gales. On the other hand, a much more favourable state of things prevailed in the Greenland sea and Denmark strait, where the ice-edge lay much more to the west than usual during the several months. According to the reports of the Duke of Orleans' ship, the *Belgica*, there was very little polar ice in the Greenland sea south of 78°, the floes consisting of flat winter ice and young ice, and showing few signs of pressure. This points to a very slight drift of ice in the polar basin during the spring. Off Newfoundland and on the Trans-Atlantic steamer routes both floes and icebergs were uncommonly abundant and persistent, navigation being still hampered as late as August. On the south-west coast of Greenland, on the contrary, the year was exceedingly favourable, and the conditions seem to have been favourable, too, in the Arctic archipelago. From the conditions on the south-eastern coast of Greenland during the late summer, it seems likely that the favourable state of affairs on the south-west coast may be repeated in 1910.

The "Shelf-ice" of the Antarctic.—The *Zeitschrift für Gletscherkunde* for January, 1910, contains a short article by E. Philippi (p. 146) upon the so-called shelf-ice—a type of ice formation which is peculiar to the Antarctic. At the beginning of 1902, O. Nordenskjöld set out from Snow Hill island in a south-westerly direction on a long sledge-journey. The first portion of the journey led over level snow-covered sea-ice, but there suddenly appeared in the neighbourhood of the so-called Seal archipelago a steep wall of ice which barred further progress. Finally, a course was struck by winding over the steep edge of a snow-drift. Once on the top, the expedition found itself upon a low, weakly undulating plateau of ice,

over which it wandered for a distance of 150 kilometres from land. The lack of any great unevenness, as well as the absence of fissures, renders it very probable that this ice-mass does not rest upon land, but covers a sea-area. Whether it floats or lies upon a shallow sea-ground, moves or is immovable, is certainly not known. According to Nordenskjöld's explanation, the ice is not derived from the glacier masses of Graham Land, and by no means supplies a huge Piedmont glacier, but originates on the spot by the heaping up of snow in shallow secluded parts of the sea, covered with ordinary sea-ice, which in course of time forms masses of ice of great thickness. To this ice formed *in situ* out of snow accumulations in the sea Nordenskiöld gives the name "shelf-ice." Nordenskjöld, however, was unable to make soundings in the neighbourhood of the shelf-ice, and thus afford direct proof of his theory; and observations made by the German South Polar and other expeditions have failed either to discover a *typical* submarine shelf stretching away from the Antarctic continent and supporting the ice-mass in question, or to render plausible his explanation of the origin of the ice. Philippi provisionally regards Nordenskjöld's low ice-terrace not as a locally formed shelf-ice, but as a floating ice of land origin.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Ground-water in Crystalline Rocks.—Much as the question of ground-water has been studied within recent years, the amount of attention devoted to the side of it concerned with crystalline rock formations has not been great. The slight porosity of crystalline rocks as compared with most sedimentary formations alters considerably the conditions of water-supply in the former, and renders it of much practical importance that further light should be thrown on those conditions. The late Baron A. E. Nordenskiöld paid some attention to the subject, and his efforts towards obtaining a water-supply by boring in some of the rocky islets off the Swedish coasts were the subject of an article in this *Journal* in 1897 (vol. 10, p. 465). The latest contribution to the subject is contained in Water Supply Paper 232 of the United States Geological Survey, which, while dealing in a general way with the underground water resources of Connecticut, contains a special section by Mr. E. E. Ellis on the occurrence of water in crystalline rocks, for the study of which Connecticut offers a particularly favourable field, over two-thirds of its surface being formed of such rocks. Mr. Ellis points out that as these absorb less than 0·5 per cent. of their volume of water, and contain less than 1 per cent. of uniformly distributed pore space, the only circulation of water which has sufficient rapidity of movement to be of value as a source of well-supply must be through joints and fractures developed subsequent to the crystallization. The systems of intersecting joints and other fissures in granite, gneiss, and schists are studied in detail, and laws deduced as to the influence of these on the circulation and storage of water. Among various points brought out, Mr. Ellis shows that, owing to the tightening of the joints with increasing depth, the storage capacity diminishes after a certain distance below the surface, and that the assertion that water can always be found by going deep enough is far from being true. A remarkable fact is the complete independence, in some localities, of neighbouring series of fractures, for in one case the pressure head in two wells only 130 feet apart differed by no less than 18 feet. The general water-level in a crystalline area shows, however, smaller variations than the water-table of a sandstone area with similar topographic relief owing to the generally rapid movement in the fracture planes. Decomposition in the neighbourhood of joints supplies a certain measure of activity of circulation, and a study of this makes it appear that the circulation is mainly along the large vertical joints, next along the minor vertical joints, and in small amounts only

along the horizontal joints. In the area studied the wells are remarkably constant,* and this shows that the area contributing to any one well must be very large, being probably in the form of long and comparatively narrow intersecting belts.

Baer's Law of River Erosion.—Prof. J. Brunhes, who is well known as an exponent of the mechanism of river-erosion, has lately continued his researches with a view to ascertaining whether a decided predominance in the erosion of the right banks of streams, such as would be involved in the acceptance of "Baer's law," can be actually observed. As a stream offering favourable conditions of observation, M. Brunhes chose the Oze, a tributary of the Brenne, which flows through the department of Côte d'Or. It has a markedly torrential character, owing to the impermeable nature of the strata over which it flows, and almost throughout its winding course is dominated by small but steep banks. M. Brunhes followed it throughout its windings for a distance of 40 kilometres (25 miles)—the stream being then (February 22, 1910) in flood—and carefully noted all places showing evidence of recent erosion. Of these, thirty-six were counted on the right, and only fifteen on the left bank, while even of the latter some were due to special circumstances. This result is similar to that obtained by Calciati in his study of the windings of the Sarine, and, as in this case, the points of attack on the right bank occurred chiefly *below* the bends, while on the left bank it was the *upper* portion of the concavity which showed the most marked effects of erosion, as if the point of attack were determined by the recoil of the current from the right bank of the curve above.*

GENERAL.

Honour to Col. Chaillé-Long.—The Charles P. Daly Medal of the American Geographical Society was presented to Col. Chaillé-Long at a meeting of that Society in February. As is well known, this American officer had some share, under Gordon's orders, in elucidating the hydrography of the upper Nile, being the first to trace a portion of the Victoria Nile between the Victoria and Albert lakes, and to bring to light its expansion into Lake Choga or Ibrahim.

OBITUARY.

Dr. W. B. Cheadle.

By the death, which occurred on March 25 of this year, of Dr. W. B. Cheadle, the Society has lost a Fellow of many years' standing, known to the geographical world of half a century ago for his adventurous journey across Canada in company with the then Viscount Milton, father of the present Earl Fitzwilliam. Dr. Cheadle was the son of the Rev. James Cheadle, vicar of Bingley, Yorkshire, and was born at Colne, Lancashire, in 1835. He was educated at Bingley Grammar School and at Caius College, Cambridge, at which college he held a scholarship. It was shortly after leaving Cambridge that he undertook the Canadian journey, the narrative of which he brought out, in conjunction with Lord Milton, under the title, 'The North-West Passage by Land.' This work is one of the most vivid and picturesque accounts of travel ever written, and it achieved a well-deserved popularity, passing

* A similar study of certain rivers of Michigan, by Prof. M. Jefferson, was referred to in vol. 31, p. 339.

through many editions. After his return to England Dr. Cheadle devoted himself to the medical profession, and, besides carrying on an extensive private practice, he held various appointments—at St. Mary's Hospital, the Royal College of Physicians, and elsewhere—and was one of the earliest champions of medical employment for women. In his younger days he won some distinction as an athlete.

CORRESPONDENCE.

The True Boundaries of the Continents.

I believe I may assume that all will agree that continents are purely physical entities, and that consequently the boundaries separating them are, and must needs be, physical, and as such entirely independent of politics, and therefore of political and administrative boundaries, as shown by the fact that, though Algeria is a part of the French dominions, it is not still a part of Europe any more than is South Africa through being an integral portion of the British Empire.

Such being the incontrovertible fact, it must needs terribly jar on a lover of geography to see any other boundary followed than the best physical line of demarcation which nature herself has set between the several continents, be that boundary ocean, river, lake, or mountain range. From this it follows that the boundary between Africa and Europe on the one hand, and Asia on the other, when they are treated of as three distinct continents, should be a line drawn through the Red sea, the deepest depression across the isthmus of Suez, the Mediterranean, the sea of Marmora, the Black sea, the Caucasus mountains, the Caspian sea, the Ural river, and the Ural mountains, as these are without question the nearest approach to a perfect continuous physical boundary which we find between these continents, and that the fact that Egypt owns as a *political* possession the Sinai region in Asia, and that Russia also is the *political* owner of lands south of the Caucasus, and has, for purely administrative purposes, formed provinces partly in Europe and partly in Asia—typical of her whole empire, which is partly European and partly Asiatic—can no more make the former African and the latter European than could the political arrangements mentioned at the opening of this paper make Algeria and South Africa parts of Europe. For, let me repeat, the continents are purely physical, and as such entirely independent of political divisions and ownerships.

There can be no comparison between one set of physical, and consequently immutable, inter-continental boundaries accepted by all and for all time, and the present artificial, arbitrary, and therefore ever-changing boundaries, which shift with every administrative rearrangement.

All present-day maps are not wrong, as very many cartographers even now give the true inter-continental boundaries.

E. Fennell.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1909-1910.

RESEARCH DEPARTMENT.

April 21, 1910.—Dr. A. STRAHAN in the Chair.

"Further experiments on Dew Ponds." By Edward A. Martin.

Fourteenth Meeting, April 25, 1910.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*Percy Missen Clark; Charles H. T. Hayman; Rev. Charles Inwood; William Jackson, M.A.; Wm. Morton Johnson; John Kennedy; Robert H. Lasch; H. M. C. Ledger; Wm. Brodie G. Littlewood; Captain Geoffrey Makins, M.V.O.; S. George M'Cormick; J. V. Phelps; Cecil Polhill; Robert A. Suffern; Harry Benedict Wall; Ernest Young.*

The paper read was—

"The Aldabra and Neighbouring Islands in the South-West Indian Ocean." By J. C. F. Fryer.

Evening Meeting of May 9, 1910. *Postponed on Account of the Death of the King.*

ELECTIONS AT COUNCIL MEETING.

Malcolm Cross; W. W. Ferguson; Geoffrey Harley; Captain Charles Louis; W. M. Knight; Captain J. H. F. Lakin (92nd Punjabis); Sidney John Lowell; Captain L. H. Sitwell (Corps of Guides, Ottawa); William James Thompson, George Traill.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Balkan Peninsula. **Hutchinson.**

Motoring in the Balkans: along the highways of Dalmatia, Montenegro, the Herzegovina, and Bosnia. By Frances Kinsley Hutchinson. London: Hodder & Stoughton, 1910. Size 9 × 6, pp. 342. *Illustrations.* *Price* 12*s. net.* *Presented by the Publishers.*

Europe. **Webb.**

A systematic geography of Europe. By George William Webb. London: Methuen & Co., 1910. Size 7½ × 5, pp. viii. and 96. *Sketch-maps.* *Price* 1*s.* *Presented by the Publishers.*

France—Languedoc. **Malavialle.**

Le Bas-Languedoc en 1626 d'après la description du géographe allemand Abraham Golnitz. Par L. Malavialle. (Extrait du Bulletin de la Société Languedocienne de Géographie, tomes 31 et 32.) Montpellier, 1909. Size 10 × 6½, pp. 146. *Presented by the Author.*

France—Loire. **Rouchon.**

Recherches sur les inondations de la Loire supérieure et de ses affluents dans le département de la Haute-Loire. Par Ulysse Rouchon. Paris: H. Champion, 1910 Size 10 × 6½, pp. xxxii. and 62. *Price* 2*s.* 8*d.*

France—South-West. **Miltoun**

Castles and chateaux of old Burgundy and the border provinces. By Francis Miltoun. London: Sir I. Pitman & Sons, 1909. Size 8 × 5½, pp. x. and 334 *Maps and Illustrations.* *Price* 7*s.* 6*d. net.* *Presented by the Publishers.*

Germany—Baden. *Notizblatt V.E. Darmstadt* **29** (1908): 35–54. **Klemm**

Bemerkungen über die Gliederung des Odenwaldes. Von G. Klemm.

Germany—Bavaria. *M.G. Ges. München* **4** (1909): 179–233. **Bayberger**

Zum Problem des Wellheimer Trockentals. Von Prof. Dr. Franz Bayberger. *Map and Profiles.*

Germany—Climate. **Dove and Frankenhauser**

Deutsche Klimatik: Grundriss der Lehre von den Luftkuren Erholungsbedürftiger und Kranker, für Ärzte, Geographen . . . [u.a.], dargestellt von Prof. Dr. Karl Dove und Dr. Frankenhauser. Berlin: D. Reimer, 1910. Size 9½ × 6½, pp. xii. and 280. *Maps.* *Price* 8*m.* *Presented by the Publisher.*

Germany—Hessen. *G.M. Hessen* **5** (1909): 1–117. **Diemer.**

Die Besiedelung des Vogelsbergs. Eine Studie zur Siedelungs- und Verkehrsgeographie. Von Walther Diemer. *Maps.*

Germany—Holstein. *Globus* **96** (1909): 366–368. **Halbfass.**

Der Selentersee im Ostholstein. Von Prof. Dr. W. Halbfass. *Plan.*

Germany—Meteorology. **Häussler.**

Beziehungen der atmosphärischen Isothermen zu der Massenerhebung der mitteldeutschen Gebirgsschwelle. Inaugural-Dissertation . . . von Ewald Häussler. Halle a. S., 1909. Size 8½ × 5½, pp. 82. *Sketch-maps.*

Germany—Relief. *G.Z.* **15** (1909): 370–386. **Reisner.**

Die Staubecken im Odergebiete, nach geographischen Gesichtspunkten. Von Heinrich Reisner. *Diagram.*

Germany—Rivers. *Notizblatt V.E. Darmstadt* **29** (1908): 105–146. **Egger.**

Beiträge zur hydrochemischen Untersuchung des Rheins und seiner hauptsächlichsten Nebenflüsse (Rhein, Neckar, Nahe, und Lahn). Von Dr. E. Egger. *Diagrams.*

Germany—Saxony. *Globus* **95** (1909): 197–200, 220–225. **Bruhns.**

Geographische Studien über die Waldhufensiedelungen in Sachsen. Von Dr. B. Bruhns. *Map.*

Germany—Silesia. *Z. Ges. E. Berlin* (1909): 379–386. **Groll.**
Die Verteilung der Bevölkerung in der Provinz Schlesien. Von Dr. M. Groll. *Sketch-maps.*

Germany—Thüringen. *M.G. Ges. Jena* **26** (1908): 1–31. **Fränzel.**
Der Einfluss der Sommerfrischen auf Volksdichte und Verkehr im nordwestlichen Teile des Thüringer Waldes. Von Dr. Ernst Fränzel.

Germany—Thüringen. *M.G. Ges. Jena* **26** (1908): 85–123. **Pistor.**
Die Thüringischen Eisenbahnen, speziell die des Thüringer Waldes, namentlich in ihren orographischen Verhältnissen. Von Dr. Hermann Pistor. *Maps and Profiles.*

Germany—Thüringen. *M.G. Ges. Jena* **26** (1908): 31–84. **Stephan.**
Ueber den Einfluss der orographischen Lage auf die interdiurne Temperaturveränderlichkeit im Thüringer Wald. Von Dr. Georg Stephan. *Diagrams.*

Greece—Delos. **Homolle and Holleaux.**
Exploration archéologique de Délos, faite par l'Ecole Française d'Athènes sous les auspices du Ministère de l'Instruction Publique . . . et publiée sous la direction de Théophile Homolle et Maurice Holleaux. Introduction: Carte de Délos au 1/10,000e avec une commentaire explicatif. Par André Bellot. Paris: Fontemoing et Cie., 1909. Size 14 × 11, pp. 44. *Maps, Diagrams, and Illustrations. Presented by the Ecole Française d'Athènes.*

Greece—Historical. *B.S.G. Lille* **52** (1909): 69–76. **Merchier.**
Le voyage de Télémaque. Par A. Merchier. *Sketch-map.*

Holland—Coast. *Ts. K. Ned. Aardr. Genoots.* **26** (1909): 1–61, 264–265. **Ramaer.**
De vorming van den Dollart en de terpen in Nederland, in verband met de geographische geschiedenis van ons polderland. Door J. C. Ramaer. *Maps.*

Iceland. **Spethmann.**
Ueberblick über die Ergebnisse der v. Knebelschen Islandexpedition im Jahre 1907. Von Hans Spethmann. (Separatabdruck aus "Gaea," 45. Jg., Heft 1 und 2.) Stuttgart, 1909. Size 9½ × 6¼, pp. 32. *Illustrations.*
Some of the results of this expedition have already been referred to in the *Journal* (vol. 31, p. 672; vol. 33, p. 595).

Italy—Climatology. *Riv. G. Italiana* **16** (1909): 484–492. **Eredia.**
La Climatologia dell' Italia. Par Filippo Eredia.

Italy—Earthquake.
Messina and Reggio before and after the earthquake of December 28, 1908. Florence: Società Fotografica Italiana, [1909]. Size 10½ × 12, pp. 438. *Maps, Illustrations, and Diagrams. Price* 13*s.* 6*d.* [Text in four languages.]
A pictorial record of the effects of the great earthquake.

Italy—Historical. *B.S.G. Italiana* **10** (1909): 716–739. **Almagia.**
La Geografia fisica in Italia nel Cinquecento. Del Prof. Roberto Almagia.

Italy—Lake Garda. *Sitzb. K.A.W. Wien*, Abt. IIa. 117 (1908): 697–780. **Defant.**
Ueber die stehenden Seespiegelschwankungen (Seiches) in Riva am Gardasee. Von Dr. Albert Defant. *Diagrams.*

Italy—Padua. **Foligno.**
The story of Padua. By Cesare Foligno. (The Mediæval Towns Series.) London: J. M. Dent & Co., 1910. Size 7 × 4½, pp. xvi. and 320. *Plan and Illustrations. Price* 4*s.* 6*d. net. Presented by the Publishers.*

Italy—Place-names. *Riv. G. Italiana* **16** (1909): 476–484. **Almagia**
Sui nomi storici di alcune vallate dell' Abruzzo e specialmente sul nome "Valle Siciliana." Por Roberto Almagia.

Italy—Vesuvius. *American J. Sci.* **28** (1909): 413–430. **Perret.**
Vesuvius: Characteristics and Phenomena of the present Repose period. By Frank A. Perret. *Illustrations.*

Mediterranean—Ethnology. *J. Asiatique* **13** (1909): 225–234. **Schwab.**
Phéniciens, Judéo-Hellènes, Berbères, dans le bassin de la Méditerranée. Par M. Moïse Schwab.

Northern Europe—Humus. *Bidrag till Kännedom Finland* **66** (1908): 1–176. **Aschan.**
Humusämnena i de nordiska inlandsvattnen och deras betydelse. särskildt vid sjömalmernas daning. Af Ossian Aschan.

Norway—Lakes. *Norske G.S. Aarbog* **20** (1909): 46–50. **Reusch.**

Nogen bemerkninger om indsjøers dannelse i Skiensvasdraget. Af Hans Reusch. *Sketch-map.*

The lakes considered are in the Skien district of Southern Norway.

Norway—Oyster-beds. **Helland-Hansen.**

Die Austernbassins in Norwegen. Von B. Helland-Hansen. (Sonderabdruck aus Internationale Revue der gesamten Hydrobiologie und Hydrographie. Band I. 1908.) Leipzig, [1908]. Size 9½ × 6½, pp. 553–573. *Diagrams and Illustrations. Presented by the Author.*

Russia—Finland—Phytogeography. **Brotherus.**

Bidrag till Kännedom Finland **66** (1908): 241–269.

Pflanzenphänologische Beobachtungen in Finland 1906. Zusammengestellt von V. F. Brotherus.

Spain: **Marden.**

Travels in Spain. By Philip Sanford Marden. London: A. Constable & Co., 1909. Size 8½ × 5½, pp. xii. and 434. *Sketch-map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Spain—Historical. **Braun.**

Quellen u. Forschungen alten Geschichte u. G. (Sieglin), Heft 17 (1909): pp. 140.

Die Entwickelung der spanischen Provinzialgrenzen in römischer Zeit. Von Franz Braun.

Spain—La Mancha. *Rev. G. Col. y Mercantil* **6** (1909): 174–179. **Coreta.**

Causas de la esterilidad de la Mancha. Por D. Francisco Vidal y Coreta.

Spain—Relief. *Z. Ges. E. Berlin* (1909): 226–257, 297–316. **Rühl.**

Geomorphologische Studien aus Catalonien. Von Dr. Alfred Rühl. *Sketch-map, Illustrations, and Sections.*

Spain and Portugal. **Blásquez.**

El periplo de Himilco (siglo VI. antes de la Era Christiana) según el poema de Rufo Festo Avieno titulado "Ora Maritima." Descripción de las costas portuguesas y españolas desde el cabo San Vicente hasta Gibraltar. Por Antonio Blázquez y Delgado-Aguilera. Madrid, 1909. Size 9 × 6½, pp. 72. *Sketch-map. Presented by the Author.*

Also printed in *Bol. R.S.G. Madrid*, vol. 51, pp. 325–392.

Sweden and Norway—Meteorology. **Hamberg.**

Nébulosité et soleil dans la péninsule scandinave. Par H. E. Hamberg. (Appendice I. aux Observations météorologiques suédoises, vol. 50, 1908.) Upsala, 1909. Size 12½ × 10, pp. vi. and 40. *Maps.* [In Swedish and French.]

United Kingdom. **Baedeker.**

Great Britain. Handbook for travellers by Karl Baedeker. Seventh edition. Leipzig (London: T. Fisher Unwin), 1910. Size 6½ × 4, pp. lxviii. and 624. *Maps and Plans. Price* 10*s. Presented by the Editor.*

United Kingdom—Canals. —

Royal Commission on Canals and Waterways. Vol. 5, Part I. Third Report (pp. viii.); Part II. England and Wales, and Scotland. Minutes of Evidence, and Appendices thereto, of the Royal Commission appointed to inquire into and to report on the Canals and Inland Navigations of the United Kingdom (pp. viii., 388, iv., and 80. *Price* 3*s.* 11*d.*). Ditto, vol. 7. Fourth and final report (pp. xiv., 238, and 30. *Map. Price* 2*s.* 11*d.*). London: Wyman & Sons, 1909. Size 13 × 8½. *Presented by the Royal Commission.*

United Kingdom—Communications. **Campbell.**

J.R. United Service I. **53** (1909): 1415–1443.

The Advantages, Strategical and Commercial, of a Battleship and Ocean-going Steamer Canal between the Forth and the Clyde. By Vice-Admiral Sir C. Campbell. *Maps and Illustration.*

United Kingdom—Sussex. **Beckett.**

The spirit of the Downs: impressions and reminiscences of the Sussex Downs. By Arthur Beckett. London: Methuen & Co., 1909. Size 9 × 5½, pp. xvi. and 366. *Illustrations. Price* 10*s.* 6*d.*

United Kingdom—West Coast. **Ashton.**

The battle of land and sea on the Lancashire, Cheshire, and North Wales coasts, with special reference to the origin of the Lancashire sandhills. By William

Ashton. Second edition. Southport (London: J. Heywood), 1909. Size 7½ × 5, pp. vi. and 218. *Maps and Illustrations. Price* 1*s.* 6*d. Presented by the Author.*

ASIA.

Afghanistan. **Thornton.**

Leaves from an Afghan scrapbook: the experiences of an English official and his wife in Kabul. By Ernest and Annie Thornton. London: J. Murray, 1910. Size 8 × 5½, pp. xvi. and 226. *Sketch-map and Illustrations. Price* 8*s. net. Presented by the Publisher.*

Asia. **Candler.**

The mantle of the East. By Edmund Candler. Edinburgh, etc.: W. Blackwood & Sons, 1910. Size 7½ × 5, pp. xvi. and 322. *Illustrations. Price* 6*s. net. Presented by the Publishers.*

Sketches of travel, principally in India.

China. **Cecil.**

Changing China. By the Rev. Lord William Gascoyne-Cecil, assisted by Lady Florence Cecil. London: J. Nisbet & Co., 1910. Size 9 × 5½, pp. xvi. and 342. *Sketch-map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

China—Ethnology. **Chavannes.**

Le T'ai Chan: essai de monographie d'un culte chinois. Appendice: le Dieu du sol dans la Chine Antique. Par Éduard Chavannes. (Annales du Musée Guimet; Bibliothèque d'Etudes, Tome 21.) Paris: E. Leroux, 1910. Size 10 × 6½, pp. 592. *Illustrations. Presented by the Author.*

Eastern Asia—Russo-Japanese War. **Semenoff.**

The price of blood. (The sequel to 'Rasplata' and 'The battle of Tsushima.') By Captain Vladimir Semenoff. London: J. Murray, 1910. Size 7½ × 5, pp. xii. and 228. *Price* 5*s. net. Presented by the Publisher.*

India. **Chailley.**

Joseph Chailley. L'Inde britannique: société indigène; politique indigène; les idées directrices. Paris: A. Colin, 1910. Size 10 × 6½, pp. xvi. and 514. *Maps. Price* 10 *fr. Presented by the Publisher.*

India—Eastern Bengal and Assam. **Playfair.**

The Garos. By Major A. Playfair. (Published under the orders of the Government of Eastern Bengal and Assam.) London: D. Nutt, 1909. Size 8½ × 5½, pp. xvi. and 172. *Maps and Illustrations. Price* 7*s.* 6*d. net. Two copies, presented by the Author and Publisher.*

India—Ethnology. **Thurston and Rangachari.**

Castes and tribes of Southern India. By Edgar Thurston, assisted by K. Rangachari. 7 volumes. Madras: Government Press, 1909. Size 10 × 6. *Illustrations. Price* 23*s. Presented.*

India—North-West Frontier. **Holdich.**

The Gates of India, being an historical narrative. By Colonel Sir Thomas Holdich. London: Macmillan & Co., 1910. Size 9 × 5½, pp. xvi. and 556. *Maps. Price* 10*s. net. Presented by the Author.*

Reviewed in the present number.

South-East Asia—Historical. **Gerini.**

Asiatic Society Monographs, No. 1. Researches on Ptolemy's geography of Eastern Asia (further India and Indo-Malay Archipelago). By Colonel G. E. Gerini. Published in conjunction with the Royal Geographical Society. London: R.A.S. and R.G.S., 1909. Size 8½ × 6½, pp. xii. and 946. *Maps.*

AFRICA.

Abyssinia—Language. **Alone.**

Short manual (with vocabulary) of the Amhāric language, prepared for the General Staff by Major J. P. Alone. London: Harrison & Sons, 1909. Size 6½ × 4, pp. iv. and 214. *Price* 5*s. Presented.*

Belgian Congo. **Piscicelli.**

Maurizio Piscicelli. Nel Paese dei Bango-Bango. Naples: Detken e Rocholl, [1910]. Size 10 × 7, pp. 388. *Maps and Illustrations. Price* 12 *lire. Presented by the Publishers.*

British East Africa. Stigand.

To Abyssinia through an unknown land. An account of a journey through unexplored regions of British East Africa by Lake Rudolf to the kingdom of Menelik. By Captain C. H. Stigand. London: Seeley & Co., 1910. Size 9 × 5½, pp. 352. *Maps and Illustrations. Price* 16*s. net. Presented by the Publishers.*

British East Africa—Game. Dugmore.

Camera adventures in the African wilds: being an account of a four months' expedition in British East Africa, for the purpose of securing photographs from life of the game. By A. Radclyffe Dugmore. London: W. Heinemann, 1910. Size 11½ × 8, pp. xviii. and 232. *Illustrations and Sketch-map. Price* 30*s. Presented by the Publisher.*

Central Africa. Swann.

Fighting the slave-hunters in Central Africa: a record of twenty-six years of travel and adventure round the great lakes, and of the overthrow of Tip-pu-Tib, Rumaliza, and other great slave-traders. By Alfred J. Swann. With an Introduction by Sir H. H. Johnston. London: Seeley & Co., 1910. Size 9 × 5½, pp. 360. *Map and Illustrations. Price* 16*s. net. Presented by the Publishers.*

East Africa—Masai. Merker.

Die Masai. Ethnographische Monographie eines ostafrikanischen Semitenvolkes. Von M. Merker. Zweite verbesserte . . . Auflage. Berlin: D. Reimer, 1910. Size 11 × 7½, pp. xxxii. and 456. *Map and Illustrations. Price* 12*m. Presented by the Publisher.*

The first edition was reviewed in Vol. 25, p. 447.

Egypt—Historical. Weigall.

The life and times of Akhnaton, Pharaoh of Egypt. By Arthur E. P. Weigall. Edinburgh, etc.: W. Blackwood & Sons, 1910. Size 9 × 5½, pp. xii. and 288. *Map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Egypt and Sudan—Zoology. Jägerskiöld.

Results of the Swedish Zoological Expedition to Egypt and the White Nile, 1901; under the direction of L. A. Jägerskiöld. Part III. Upsala, 1909. Size 9½ × 6½, pp. [244]. *Illustrations. Presented by the Library of the Royal University, Upsala.*

A series of memoirs, by experts, on the various groups represented in the collections.

Egyptian Sudan. Tangye.

In the torrid Sudan. By H. Lincoln Tangye. London: J. Murray, 1910. Size 9 × 5½, pp. xii. and 300. *Map and Illustrations. Price* 12*s. net. Presented by the Publisher.*

German East Africa.

Eine Reise durch die Deutschen Kolonien. Herausgegeben von der illustrierten Zeitschrift "Kolonie und Heimat." I. Band: Deutsch-Ostafrika. Berlin: Verlag Kolonialpolitischer Zeitschriften G. m. b. H., 1909. Size 10½ × 13½, pp. viii. and 128. *Illustrations and Sketch-maps. Price* 5*s.*

A good selection of pictures, with letterpress.

German East Africa—Ethnology. Weiss.

Die Völkerstämme im Norden Deutsch-Ostafrikas. Von Max Weiss. Berlin: Carl Marschner, 1910. Size 10½ × 7½, pp. xx. and 456. *Maps and Illustrations. Presented by the Publisher.*

This will be specially reviewed.

Italian Somaliland. Mantegazza.

Vico Mantegazza. Il Benadir. Milan: Fratelli Treves, 1908. Size 7½ × 5, pp. 364. *Maps and Illustrations. Price* 5 *lire.*

Morocco. Brives.

A. Brives. Voyages au Maroc (1901–1907). Algiers: A. Jourdan, 1909. Size 11 × 9, pp. x. and 612. *Maps, Sections, and Illustrations. Price* 20 *fr.*

Nigeria—Ethnology. Edgar.

A grammar of the Gbari language with Gbari-English and English-Gbari dictionaries. By Major Francis Edgar. [Belfast: printed by W. & G. Baird], 1909. Size 8½ × 5½, pp. 374. *Price* 18*s. Presented by the Author.*

Nigeria—Mineral Survey. Dunstan.

Southern Nigeria. Report on the results of the Mineral Survey, 1905–1906.

Ditto, 1906–07. By Prof. Wyndham R. Dunstan. (Colonial Reports, Miscellaneous, Nos. 67, 68, 1910.) Size 9½ × 6; pp. 28 and 36.

Nile. **Lyons.**

Ministry of Finance, Egypt. Survey Department Paper No. 14. The Rains of the Nile Basin and the Nile Flood of 1908. By Captain H. G. Lyons. Cairo, 1909. Size 10½ × 7½, pp. 70. *Map and Diagrams. Presented by the Director-General.*

Nyasaland. **Dunstan.**

Nyasaland Protectorate. Report on the results of the Mineral Survey, 1907–08, No. II. of series. By Prof. Wyndham Dunstan. (Colonial Reports, Miscellaneous, No. 60, 1909.) London: Wyman & Sons, 1909. Size 9½ × 6, pp. 46. *Sketch-map.*

Orange River Colony. **Beak.**

The aftermath of war: an account of the repatriation of Boers and natives in the Orange River Colony, 1902-1904. By G. B. Beak. London. E. Arnold, 1906. Size 9 × 5½, pp. x. and 296. *Map and Illustrations. Price* 12*s.* 6*d net. Presented by the Author.*

Portuguese West Africa—Labour. **Cadbury.**

Labour in Portuguese West Africa. By William A. Cadbury. 2nd edit. London: G. Routledge & Sons, 1910. Size 7½ × 5, pp. xii. and 188. *Map. Price* 2*s.* 6*d. net. Presented by the Publishers.*

Sahara. **Vischer.**

Across the Sahara from Tripoli to Bornu. By Hanns Vischer. London: E. Arnold, 1910. Size 9 × 5½, pp. xx. and 398. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

Sahara. *La G., B.S.G. Paris* **20** (1909): 155-164. **Cortier.**

Exploration au Sahara. Par lieutenant Cortier. *Sketch-map.*

Cf. note in vol. **34**, p. 682.

Sahara. **Leca.**

Renseignements Col., Afrique française **19** (1909). 169-179, 205-210, 232-246, 278-283.

Voyage à travers le Sahara. Par le Capitaine Colonna de Leca. *Map.*

The last article of the series sums up the author's conclusions as to the exploitation of the Sahara.

Sahara—Janet. *Rev. Française* **34** (1909). 592 602. **Cufino.**

L'oasis de Djanet. Par Luigi Cufino. *Maps.*

Sierra Leone. **Alldridge.**

A transformed colony: Sierra Leone as it was, and as it is: its progress, peoples, native customs, and undeveloped wealth. By S. J. Alldridge. London: Seeley & Co., 1910. Size 9 × 5½, pp. 368. *Maps and Illustrations. Price* 16*s. net. Presented by the Publishers.*

South Africa—Agriculture. **Blyth.**

South Africa. Report on Agriculture and Viticulture in South Africa. By Lord Blyth. (Colonial Reports, Miscellaneous, No. 61, 1900.) London: Wyman & Sons, 1909. Size 9½ × 6, pp. 26.

South Africa—Historical. **Theal.**

History of South Africa since September, 1795. By Dr. George McCall Theal. Vols. i.–iv. London: Sonnenschein & Co., 1908. Size 8½ × 5½. *Maps. Price* 7*s.* 6*d. per volume. Presented by the Publishers.*

South-West Africa. *Nature* **81** (1909): 466-467, 499-500. **Pearson.**

Percy Sladen Memorial Expedition in South-West Africa, 1908–09. By H. H. W. Pearson. *Sketch-maps and Illustrations.*

Spanish Guinea. *Ann. G.* **18** (1909): 433–450. **Cottes.**

La Guinée Espagnole. Par A. Cottes. *Sketch-maps.*

Transvaal—Geology.

Transvaal Mines Department. Report of the Geological Survey for the year 1908. Pretoria, 1909. Size 11 × 8½, pp. 174. *Maps, Sections, Plan, and Illustrations.*

Besides the director's report there are papers on special areas, most of them giving some account of the physical features.

Tunis. *Le Tour du Monde* **15** (1909): 493–516. **Chantre.**

Sur les Routes de Tunisie. Par Mme. B. Chantre. *Illustrations.*

Uganda.

Uganda. Report on the Botanical, Forestry, and Scientific Department, for the year ended March 31, 1909. (Colonial Reports, Miscellaneous, No. 64, 1909.) London: Wyman & Sons, 1909. Size 9½ × 6, pp. 28.

Uganda—Forestry. *J. African S.* **9** (1910): 120–128. **Dawe.**

The Forests of Uganda. By M. T. Dawe. *Illustrations.*

NORTH AMERICA.

Labrador. **Gosling.**

Labrador: its discovery, exploration, and development. By W. G. Gosling. London: Alston Rivers, Ltd., 1910. Size 9 × 6, pp. xii. and 574. *Maps and Illustrations. Price* 21*s. net. Presented by the Publishers.*

Mexico—Historical. **Diaz and Maudslay**

The true history of the conquest of New Spain. By Bernal Díaz del Castillo, one of its conquerors. Edited and published in Mexico by Genaro García. Translated into English, with Introduction and Notes, by Alfred Percival Maudslay. Vol. 2. (Works issued by the Hakluyt Society, Second Series, No. 24.) London, 1910. Size 9 × 5½, pp. xvi. and 344. *Plans and Illustrations. Presented by the Hakluyt Society.*

See review of Vol. 1 in the January number, p. 68. This instalment carries the story down to the halt at Tepeaca following on the flight from Mexico city.

United States—Colorado. *U.S. Geol. Surv., Prof. Paper* **67** (1909): pp. 58. **Howe**

Landslides in the San Juan mountains, Colorado, including a consideration of their causes and their classification. By Ernest Howe. *Sketch-map and Illustrations.*

United States—Connecticut. **Gregory and Ellis.**

U.S. Geol. Surv., Water-Supply Paper **232** (1909): pp 200.

Underground water resources of Connecticut. By Herbert E Gregory, with a study of the occurrence of water in crystalline rocks, by E. E. Ellis. *Sketch-maps, Sections, Diagrams, and Illustrations.*

Noticed *ante*, p. 726.

United States—Heights. *National G. Mag* **20** (1909): 539–541.

The Highest Point in Each State. *Illustration.*

United States—Idaho and Montana. **Calkins and McDonald.**

U.S. Geol. Surv. B. **384** (1909): pp. 112.

A geological reconnaissance in Northern Idaho and North-Western Montana. By F. C. Calkins, with notes on the Economic Geology, by D. F. McDonald. *Map, Illustrations, and Sections.*

United States—Magnetism. **Hazard.**

Department of Commerce and Labor. Coast and Geodetic Survey. Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory at Cheltenham, Maryland, 1905 and 1906. By Daniel L. Hazard. Washington, 1909. Size 11 × 9, pp. 110. *Diagrams.*

United States—Meteorology. *J.G.* **8** (1909): 25–31. **Brown.**

Indian Summer. By Robert M. Brown. *Sketch-maps.*

Explains the atmospheric pressure conditions conducive to Indian Summer.

United States—Negro. **Archer.**

Through Afro-America: an English reading of the race problem. By William Archer. London: Chapman & Hall, 1910. Size 9 × 5½, pp. xvi. and 296. *Price* 10*s.* 6*d. net. Presented by the Publishers.*

United States—Nevada—Geology. **Ransome and others.**

U.S. Geol. Surv., Prof. Paper **66** (1909): pp. 258.

The Geology and Ore Deposits of Goldfield, Nevada. By Frederick Leslie Ransome; assisted in the field by W. H. Emmons and G. H. Garry. *Maps, Plans, Sections, and Illustrations.*

United States—New Jersey. **Harshberger.**

P.A. Nat. Sc. Philadelphia **61** (1909): 373–400.

The Vegetation of the Salt Marshes and of the Salt and Fresh Water Ponds of Northern Coastal New Jersey. By John W. Harshberger. *Plans.*

United States—New Mexico. *U.S. Geol. Surv. B.* **389** (1909): pp. 142 **Lee and Girty.**
The Manzano Group of the Rio Grande Valley, New Mexico. By Willis T. Lee and George H. Girty. *Sketch-map, Sections, and Illustrations*
A discussion of the "Red beds" of the region in question.

United States—Ohio. *Popular Sc. Monthly* **75** (1909): 479–489. **Carney.**
Geographic Influences in the Development of Ohio. By Prof. Frank Carney.

United States—Old Volcanoes. *J.G.* **8** (1909): 56–61. **Smith.**
A Study of Volcanic Topography. By Ethel M. Smith.

United States—Railways. *B. American G.S.* **41** (1909): 610–621. **Johnson.**
Characteristics of American Railway Traffic: a Study in Transportation Geography. By Emory R. Johnson.

United States—West Virginia. **Gannett and Baldwin.**
U.S. Geol. Surv. B. **399** (1909): pp. 82.
Results of Spirit Leveling in West Virginia, 1896 to 1908, inclusive. Compiled by S. S. Gannett and D. H. Baldwin.

CENTRAL AND SOUTH AMERICA.

Brazil—Ethnology. **Koch-Grünberg.**
Zwei Jahre unter den Indianern: Reisen in Nordwest-Brasilien 1903–1905. Von Dr. Theodor Koch-Grünberg. II. Band. Berlin: E Wasmuth, 1910. Size 11½ × 8, pp. 414. *Maps and Illustrations. Price* 11*m.* 75.

Colombia—Barranquilla. **Revollo.**
Geografía del Departamento de Barranquilla y Divisiones naturales de la República de Colombia. Por Andres M. B. Revollo. Primera Edicion. Bogotá, 1909 Size 7 × 5, pp. 94. *Illustrations. Presented by the Author.*

Hayti. **Aubin.**
Eugène Aubin. En Haïti: planteurs d'autrefois; nègres d'aujourd'hui. Paris. A. Colin, 1910. Size 7½ × 6½, pp. xxxvi. and 348. *Map and Illustrations. Price* 5 *fr. Presented by the Publisher.*

Patagonia—Andes. **Krüger.**
Petermanns M., Ergänzungsheft **164** (1909): pp iv. and 242.
Die Patagonischen Anden zwischen dem 42 und 44 Grade südlicher Breite. Reisen, Studien und Aufnahmen ausgeführt im Auftrag der chilenischen Regierung von Dr. Paul Krüger. *Map and Illustrations.*

Peru. **Bingham.**
Cuzco and Sacsahuaman. By Hiram Bingham. (From 'Records of the Past,' vol. 8, Part V., 1909.) N.P., 1909. Size 11 × 7½, pp. 223–242. *Illustrations. Presented by the Author.*

Peru—Coast. *B. Cuerpo Ingen. Minas Peru* (1909): No. 70, pp. 112. **Marsters.**
Informe sobre la Costa sur del Peru. Par V. F. Marsters. *Map and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

New Zealand—Survey. **Humphries.**
New Zealand: Department of Lands. Report on the survey operations for the year 1908-9. By Thomas Humphries. Wellington, 1909. Size 13½ × 8½, pp. 22. *Maps, Plans, and Diagrams.*

New Zealand—Tongariro. *T. New Zealand I.* **41** (1908 1909): 102–105. **Marshall.**
Crater of Ngauruhoe. By Dr. P. Marshall. *Illustrations.*

New Zealand—Waimarino. **Turner.**
New Zealand: Department of Lands. Report on a Botanical Examination of the Higher Waimarino District. By E. Phillips Turner. Wellington, 1909 Size 13 × 8½, pp. 14. *Map and Illustrations.*

New Zealand—Wairarapa. *T. New Zealand I.* **41** (1908): 429–437. **Hill.**
The Great Wairarapa: A lost river. By H. Hill. *Sketch-maps and Sections.*
See note in the May number, p. 599.

Tasmania. *J.R. Colonial I.* **41** (1909–10): 21–35. **McCall.**
Tasmania: its Resources and Future. By the Hon. John McCall.

Western Australia—Geology. **Gibson.**

Western Australia Geol. Survey B. 37 (1909): pp. 30.

The Geological Features of the Country lying along the Route of the Proposed Transcontinental Railway in Western Australia. By Chas. G. Gibson. *Map and Illustrations.*

POLAR REGIONS.

Arctic—Barents Sea. **Bénard.**

Société d'Océanographie du Golfe de Gascogne. Dans l'océan glacial et en Nouvelle-Zemble (Avril-Septembre, 1908). Par le Commdt. Charles Bénard. Paris: A. Michel, [1909]. Size 10 × 7, pp. 194. *Maps and Illustrations. Price* 10 *fr.*

Polar Exploration. **Greely.**

Handbook of Polar discoveries. By A. W. Greely. Fourth edition. London: T. Fisher Unwin, 1910. Size 8½ × 5½, pp. x. and 336. *Maps and Portrait. Price 6s. net. Presented by the Publisher.*

MATHEMATICAL GEOGRAPHY.

Geology. **Wagner.**

Lehrbuch der Geologie und Mineralogie für höhere Schulen. Grosse Ausgabe. . . . Von Dr. Paul Wagner. 2 und 3. Auflage. Leipzig: B. G. Teubner, 1910. Size 9 × 6, pp. viii. and 222. *Illustrations. Price* 2.80*m. Presented by the Publishers.*

Geophysics. **Clairaut.**

Théorie de la figure de la terre, tirée des principes de l'hydrostatique. Par [A.] Clairaut. Paris, 1808. [Réimpression facsimilé. Paris: A. Hermann et Fils, 1909.] Size 8½ × 5½, pp. xl. and 308. *Diagrams. Price 5s.*

Facsimile reprint of an important early work.

Oceanography—Pacific. **Murray and Lee.**

The depth and marine deposits of the Pacific. By John Murray and G. W. Lee. (Memoirs of the Museum of Comparative Zoology at Harvard College, vol. 38, No. 1.) Cambridge, Mass., 1909. Size 12 × 10, pp. 170. *Maps and Illustrations. Presented by the Authors.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Oceanography—North Sea. **Helland-Hansen and Nansen**

Die jährlichen Schwankungen der Wassermassen im norwegischen Nordmeer in ihrer Beziehung zu den Schwankungen der meteorologischen Verhältnisse, der Ernteerträge und der Fischereiergebnisse in Norwegen. Von Bjorn Helland-Hansen und Fridtjof Nansen. (Separatabdruck aus Bd. II. der Internationalen Revue der gesamten Hydrobiologie, etc.) Leipzig, 1909. Size 9½ × 6½, pp. 337–361. *Sketch-chart and Diagrams.*

Oceanography—North Sea. **Ostenfeld.**

Immigration of a Plankton Diatom into a quite new Area within recent years; *Biddulphia sinensis* in the North Sea Waters. By Dr. C. H. Ostenfeld. (Sonderabdruck aus Internationale Revue der gesamten Hydrobiologie und Hydrographie, Band II., 1909.) Leipzig, 1909. Size 9 × 6½, pp. 362–374. *Charts and Illustrations. Presented by the Author.*

Cf. note in vol. 34, p. 678.

Oceanography—Sea-water. *Ann. Hydrographie* 37 (1909): 492–500. **Forch.**

Der Druckgradient im Meerwasser in seiner Abhängigkeit von Temperatur- und Salzverteilung. Von Dr. Carl Forch. *Diagrams.*

Oceanography—Sea-water. *Rev. Maritime* 183 (1909): 5–12. **Thoulet and Chevallier**

Mesure des densités d'eaux marines par flotteurs totalement immergés. Par J. Thoulet et Chevallier.

Oceanography—South Pacific. *Ann. Hydrographie* 37 (1909): 489–492. **Brennecke.**

Salzgehaltbestimmungen aus dem südwestlichen Stillen Ozean. Weitere Ergebnisse der ozeanographischen Beobachtungen S.M.S. *Planet*, 1908. [Von Dr. W. Brennecke.] *Diagrams.*

Petroleum. **Dalton.**

On the Origin of Petroleum. By Leonard V. Dalton. (Reprinted from *Economic Geology*, vol. 4, No. 7, October–November, 1909.) New Haven, Conn., 1909. Size 10 × 7½, pp. 604–631. *Presented by the Author.*

Phytogeography—Peat-bogs. *Z. Ges. E. Berlin* (1909): 317 331. **Potonié.**

Die Bildung der Moore. Von Prof. Dr. H. Potonié. *Illustrations.*

River Erosion. *J.G.* 7 (1909): 158-163. **Shattuck.**

Concentration versus Transportation: a Need of Accurate Measurements of Stream Work. By George B. Shattuck. *Illustrations.*

Expresses doubt as to the power of streams to move much of the *débris* in their beds.

Solar Radiation. **Samec.**

Sitzb. K.A.W. Wien, I. Abt. 116 (1907): 1061–1073; 117 (1908): 521 528.

Zur Kenntnis der Lichtintensitäten in grossen Seehöhen. I., II., Mitteilung. Von Dr. Maximilian Samec.

On observations of the intensity of light at high altitudes.

Volcanoes. **Brun.**

Verhalten des Schwefels in tätigen Solfataren. Von Albert Brun. (Sonderabdruck aus der *Chemiker-Zeitung*, 1909, No. 15.) Cöthen (Anhalt), 1909. Size 8½ × 5½, pp. 2.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial—Ocean-routes. **Brown.**

Brown's North Sea, Baltic, and Mediterranean distance tables. Glasgow: J. Brown & Son, 1909. Size 7½ × 5, pp. iv. and 70. *Maps. Price 2s. 6d. net. Presented by the Publishers.*

Languages. **Finck.**

Die Sprachstämme des Erdkreises. Von Prof. Dr. Franz Nikolaus Finck (pp. viii. and 144). Die Haupttypen des Sprachbaus. By the same (pp. vi. and 156). (Aus Natur und Geisteswelt: Sammlung wissenschaftlich-gemeinverständlicher Darstellungen, 267 und 268 Bändchen.) Leipzig: B. G. Teubner, 1909-10. Size 7 × 6½. *Price 1.25m. each. Presented by the Publishers.*

GENERAL.

Education. **Archer and others.**

The teaching of geography in Elementary Schools. By R. L. Archer, W. J. Lewis, and A. E. Chapman. London: A. & C. Black, 1910. Size 7½ × 5, pp. 256. *Diagrams. Price 3s. 6d. net. Presented by the Publishers.*

Education—Text-book. **Mort.**

An elementary practical geography for middle forms. By Frederick Mort. London: Blackie & Son, 1909. Size 8½ × 6½, pp. 92. *Maps and Diagrams. Price 2s. Presented by the Publishers.*

Education—Text-book. **Reynolds.**

Elementary Regional Geography. Ireland and Great Britain in outline. By J. B. Reynolds. London: A. & C. Black, 1910. Size 7 × 4½, pp. viii. and 184. *Sketch-maps, Illustrations, and Diagrams. Price 1s. 4d. Presented by the Publishers.*

Education—Text-book. **Wallis.**

A key to Practical exercises in geography: a two years' course. By B. C. Wallis. London: Macmillan & Co., 1910. Size 7½ × 5, pp. viii. and 84. *Price 3s. 6d. net. Presented by the Publishers.*

Orient. **Banse**

Der Orient: eine Länderkunde. Von Ewald Banse. I. Die Atlasländer (pp. iv and 112); II. Der arabische Orient (pp. iv. and 110); III. Der Arische Orient (pp. iv. and 104). Leipzig: B. G. Teubner, 1910. Size 7½ × 5. *Sketch-maps, Illustrations, and Diagrams. Price 1 M. 25 each. Presented by the Publisher.*

Travel. **Hogarth.**

Accidents of an antiquary's life. By D. G. Hogarth. London: Macmillan & Co., 1910. Size 9 × 5½, pp. x. and 176. *Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Travel—Hints. **Stewart.**

Active Service pocket-book. By Bertrand Stewart. Fourth edition. London: W. Clowes & Sons, [1910]. Size 5½ × 4½, pp. xxxiv. and 1024. *Sketch-maps, Diagrams, and Illustrations. Price 4s. net. Presented by the Publishers.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria-Hungary. **Kiesewetter.**

Karte der Meer- und Hafenfernen von Osterreich-Ungarn. Von Dr. J. Kiesewetter. Scale 1 : 5,000.000 or 1 inch to 88·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 32. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Balkan Peninsula. **Freytag.**

G. Freytag's Generalkarte von Dalmatien, Bosnien und der Hercegovina. Scale 1 : 600,000 or 1 inch to 9·5 stat. miles. Vienna: G. Freytag & Berndt, [1910]. *Price 4 kr. Presented by the Publishers.*

An orographically coloured map, with the tinting over somewhat too dark and heavy hill shading, with the consequence that the smaller names and detail are not so clear as they should be.

British Isles. **Bartholomew.**

Bartholomew's reduced survey map of the British Isles. Scale 1 : 633,600 or 1 inch to 10 stat. miles. 2 Sheets. New edition. Edinburgh: John Bartholomew & Co., 1910. *Price, mounted on cloth*, £1 1s. *Presented by the Publishers.*

A new edition of this useful general map of the British Isles, at a reduced price, revised and corrected to date. There are numerous inset maps and plans showing parliamentary divisions and environs of important towns. No attempt at hill shading has been made, but the heights of important points are given in figures, with a mere indication of the hill or peak in vertical hachures. The map, when joined together and mounted on rollers, measures 5 feet 4 inches by 4 feet 8 inches.

British Isles—England. **Bartholomew.**

Plan of Norwich based upon the Ordnance Survey Map. By J. G. Bartholomew. Scale 1 : 10,560 or 6 inches to 1 stat. mile. Edinburgh: John Bartholomew & Co., [1910]. *Price 1s. net. Presented by the Publishers.*

British Isles—England. **Feigerl**

Contour Relief Model of the greater part of Sussex. Prepared from the Ordnance Survey by G. R. C. Feigerl. Horizontal scale 1 : 126,720 or 1 inch to 2 stat. miles, vertical scale 1 : 21,120 or 3 inches to 1 stat. mile. London: Sifton & Praed, [1910]. *Price* £2 5s.

This model is a continuation of the two noticed in the *Geographical Journal* for March last, and completes the series from the country immediately north of London to the south coast. In style of production it is similar to those previously published, and apart from the fact that the vertical scale is perhaps unnecessarily exaggerated, gives an excellent idea of the general relief of the district it includes.

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from April 1 to 30, 1910.

4 miles to 1 inch:—

Revised in outline. Engraved. Sheet (9 & 10). *Price* 1s. 6d.

1-inch map—(third edition):—

Outline. Engraved. Sheet 87. *Price* 1s.

6-inch—County Maps:—

Cheshire, 5 sheets. **Hampshire**, 3 sheets. **Kent**, 5 sheets. **Lancashire**, 1 sheet. **Sussex**, 12 sheets. **Yorkshire**, 29 sheets. *Price* 1s *each.*

25-inch—County Maps:—

Cheshire, 51 sheets. **Hampshire**, 31 sheets. **Sussex**, 24 sheets. **Yorkshire**, 30 sheets. *Price* 3s. *each.*

(*E. Stanford, London Agent.*)

British Isles—England and Wales. **Geological Survey.**

1-inch map:—

New Series, colour printed. Solid and Drift editions, Carmarthen, Sheet 229. *Price* 1s. 6d. *each.*

6-inch map:—

Quarter sheets, uncoloured; Derbyshire, 1 sheet. Nottinghamshire, 1 sheet. *Price* 1s. 6d. *each.*

(*E. Stanford, London Agent.*)

British Isles—Scotland. **Gwinnel.**

Contour Relief-model of the northern part of the Clyde basin, including Loch Lomond. By Russell F. Gwinnel, B.SC., F.G.S. Horizontal and vertical scale 1:126,720 or 1 inch to 2 stat. miles. London: George Philip & Son, [1910]. *Price, including memoir*, 15*s*.

This is an interesting relief model, measuring 15½ inches by 9½ inches, of the northern part of the Clyde basin, including Loch Lomond, Gareloch, Loch Long, and Loch Eck, with the towns of Greenock, Gourock, Dunoon, Dunbarton, Helensburgh and Row. It is made of Parian cement, and is supplied in a leather-board box. Heights are shown, on the layer system, at 250-feet intervals, and one point greatly in its favour is that the horizontal and vertical scales are the same. However, the step-like appearance of the land, owing to the layer system adopted, gives a somewhat erroneous idea of the actual land relief, and it might have been better to have graduated the slopes instead of showing them as a series of terraces. The model is issued plain, coloured orographically or geologically. It is accompanied by a pamphlet by Mr. Gwinnel, describing the district.

France. **Peterman Mitteilungen.**

Die Besitzverhältnisse des französischen Eisenbahnnetzes nach der Verstaatlichung der Westbahn-Linien. Scale 1:3,700,000 or 1 inch to 58·4 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 39. Gotha: Justus Perthes, 1910. *Presented by the Publishers.*

Germany. **Gradmann.**

Kartenskizzen zur Siedlungsgeographie Württembergs. Von Dr. Rob. Gradmann. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 31. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Germany. **Königl. Sächs. Generalstabes.**

Karte des Deutschen Reiches. Herausgegeben von der Abteilung für Landesaufnahme des Königl. Sächs. Generalstabes. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Sheets: (Kupferdruckausgabe) 418, Bischofswerda; 419, Bautzen; 444, Königstein. *Price* 1.50*m. each sheet.* (Umdruckausgabe) 418, Bischofswerda; 419, Bautzen; 444, Konigstein. *Price* 0·50*m each sheet.* Dresden: G. A. Kaufmann, 1909.

ASIA.

India. **Johnston**

Railway map of India. Scale 1:3,150,000 or 1 inch to 50 stat. miles. 2 sheets. Edinburgh & London: W. & A. K. Johnston, Ltd., 1910. *Price, mounted on rollers and varnished*, 12*s*. *Presented by the Publishers.*

This map like the one below, shows railways, railway systems, gauges of line, etc., in India and Burma, but only the more important stations are given. It is clearly drawn and printed in colours.

India. **Taylor.**

Taylor's A.B.C. Railway map of India, with complete index, alphabetically arranged, of every station in India and Burma. Corrected to April 30, 1909. Scale 1:2,027,520 or 1 inch to 32 stat. miles. *Price* £2 2*s*.

The various railway systems, gauges of lines, and lines under construction are clearly distinguished on this map by colouring and symbols. The alphabetical list and index to stations which is given on the map will be most useful for reference, and adds considerably to its value. Besides the special information concerning railways, very rightly, little else is given, and the map itself is only an outline.

Indian Government Surveys. **Surveyor-General of India.**

India and adjacent countries: scale 1 inch to 256 miles; scale 1 inch to 32 miles, 6 sheets; scale 1: 1,000,000, 1 sheet (parts of United Provinces, Central India, etc.); scale 1 inch to 1 mile, North-West Frontier Province, 7 sheets; Punjab and North-West Frontier Province, 2 sheets; Punjab and Baluchistan, 8 sheets; Bombay, 1 sheet; Bombay and Central India, 1 sheet; Madras, 2 sheets; United Provinces and Central India, 9 sheets; Berar, 1 sheet; Bengal, 5 sheets; Eastern Bengal and Assam, 9 sheets; Burma, 12 sheets.—Punjab, North-West Frontier Province and Kashmir: scale 1 inch to 16 miles, 4 sheets.—Bengal Survey: scale 1 inch to 1 mile, 2 sheets.—United Provinces Survey: scale 1 inch to 1 mile, 5 sheets. Calcutta: Surveyor-General's Office, 1908–09. *Presented by the Secretary of State for India, through the India Office.*

Malay Peninsula. **Surveyor-General, Federated Malay States.**

Preliminary map of Pahang, Federated Malay States. Compiled from surveys

by the Trigonometrical Survey Department, Federated Malay States, under the direction of A. E. Young, A.M.I.C.E., F.R.A.S., Chief Surveyor. Scale 1: 253,440 or 1 inch to 4 stat. miles. 3 sheets. Taiping: Surveyor-General's Office, 1909. *Presented by the Surveyor-General, Federated Malay States.*

An outline map without hill-shading, giving height of trigonometrical stations and hills fixed by intersection in figures. Railways constructed, under construction, and surveyed are shown, as well as roads and paths, rest-houses, police stations, post offices, and other useful information.

AFRICA.

Africa. **Geographical Section, General Staff.**

Africa. Scale 1: 1,000,000 or 1 inch to 15·8 stat. miles. Sheet: Lake Victoria (Provisional Issue). Geographical Section, General Staff. London: Edward Stanford, 1910. *Price* 1*s.* 6*d. net. Presented by the Director of Military Operations.*

Africa. **Geographical Section, General Staff.**

Map of Africa. Scale 1: 250,000 or 1 inch to 3·9 stat. miles. Sheets: 66-H, Beni Shangul, Egyptian Sudan; 66-L, Walega, Abyssinia; 66 P, Goré, Abyssinia; 67-M, Leka, Abyssinia; 78-D, Abyssinia; 79-A, Anderacha, Abyssinia.—Cape Colony Series. Sheets: 127-K and L, Port Nolloth and D'Okiep; 127-R, Bowersdorp; 128-A, Warmbad; 128-D, Upington; 128-E and K, Prieska; 128-L, Strydenburg; 128-R, Britstown; 129-P, Zastron. Geographical Section, General Staff, War Office, London: Edward Stanford, 1908–09. *Price* 1*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

Africa. **Service Géographique de l'Armée, Paris.**

Carte de la Frontière Algero-Marocaine. Scale 1: 100,000 or 1 inch to 1·6 stat. miles. 2 sheets. Paris: Service Géographique de l'Armée, [1910]. *Price* 1.25 *fr. each sheet.*

The two northern sheets of a map of the Moroccan territory immediately adjacent to the frontier of Algeria. Contours are given at 25-metre intervals.

Egypt. **Survey Department, Cairo.**

Topographical map of Egypt. Scale 1: 50,000 or 1·3 inch to 1 stat. mile. Sheet N.W. VII.–II. Fua. Cairo: Survey Department, 1909. *Presented by the Survey Department, Cairo.*

Egypt. **Survey Department, Cairo.**

Topographical map of North Gharbia. Scale 1: 25,000 or 2·5 inches to 1 stat. mile. Sheets: N.E. Nos.: VII–I., 1, 2, 3, 4; VII.–II., 1, 2, 3; VII.–III., 1, 3; VIII. I., 2, 3, 4; VIII.–II., 1, 2, 3, 4; VIII.–III., 3, 4; VIII.–IV.–1, 3; N.W. Nos.: VII.–I., 1, 2, 3, 4; VII.–II., 1, 2, 4; VII.–III., 2; VIII.–I., 1, 2, 3, 4; VIII.–II., 2 and 4, 3; VIII.–III., 1, 2, 3, 4. Cairo: Survey Department, 1909 *Presented by the Director-General, Survey Department, Cairo.*

Egypt. **Survey Department, Cairo.**

Topographical map of Kharga Oasis. Scale 1: 10,000 or 6·3 inches to 1 stat. mile. Sheets: S.W. 117–9, 10; 118–8, 9, 10; 119–8, 9, 10. Cairo: Survey Department, 1910. *Presented by the Director-General, Survey Department, Cairo.*

Morocco. **Service Géographique de l'Armée, Paris.**

Region de Casablanca. Scale 1: 100,000 or 1 inch to 1·6 stat. mile. Sheet 3, Oulad Saïd. Paris: Service Geographique de l'Armée, [1910]. *Price* 1 *fr. each sheet.*

AMERICA.

Alaska. **U.S. Department of the Interior**

Alaska. Compiled from the official records of the General Land Office, Coast and Geodetic Survey, Geological Survey, Canadian and other sources, under the direction of J. P. Berthrong, Chief of Drafting Division, General Land Office. Scale 1: 3,801,600 or 1 inch to 60 stat. miles. Washington: U.S. Department of the Interior, 1909.

A general map of Alaska, showing by various colours and symbols, boundaries, national forests, agricultural experiment stations, fish reserves, military signal corps cable stations, naval, marine hospital, reindeer, moose, bird reserves, public school reserves, and Indian reservations.

Brasil. **Le Cointe.**

Carte du cours de l'Amazone depuis l'Ocean jusqu'à Manaos et de la Guyane Brésilienne. Dressée par Paul Le Cointe d'après ses relevés personnels (1892–

1906). Scale 1: 2,000,000 or 1 inch to 31·5 stat. miles. Paris: Armand Colin, 1906.

This map includes the region between Venezuela, British, Dutch, and French Guiana, and the Amazon and Rio Negro rivers. It has been compiled from the surveys of M. Paul le Cointe, combined with those of earlier travellers from M. da Gama Lobo de Almada (1787) to Condreau (1900–1905). The explorations have been confined to the courses of rivers, and between these the region is still practically unknown. Rapids are marked, and heights on the rivers given in red, together with the names of the explorers and dates of their journeys. The furthest point reached in each case is marked by a red cross. The map is accompanied by a leaflet giving an account of the region and its exploration.

Canada. **Department of the Interior, Ottawa.**

Map of Manitoba, Saskatchewan, and Alberta. Scale 1: 792,000 or 1 inch to 12·5 stat. miles. Special edition, showing disposition of lands, corrected to January 1, 1910. Prepared in the Railway Lands Branch. 3 sheets. Ottawa: Department of the Interior, 1910. *Presented by the Department of the Interior, Ottawa.*

Canada. **Department of the Interior, Ottawa.**

Northern Alberta. Special edition prepared in the Railway Lands Branch, showing lands finally disposed of. Scale 1: 792,000 or 1 inch to 12·5 stat. miles. Fourth edition, corrected to January 1, 1910. Ottawa: Department of the Interior, 1910. *Presented by the Department of the Interior, Ottawa.*

Shows by different colours homesteads patented to January 1, 1910; homesteads unpatented entered prior to January 1, 1909; homesteads entered between January 1, 1909, and January 1, 1910; even-numbered and odd-numbered sections patented or finally disposed of otherwise than as homesteads, Indian reserves, Indian reserves surrendered and sold, timber berths, known outcrops of bar sands, mounted police stations, and coal-seams. In addition to this information, there are many notes on the maps descriptive of the character of the country, breadth, and navigability of rivers, etc.

Canada. **Department of the Interior, Ottawa.**

Standard Topographical map of Canada. Scale 1 . 500,000 or 1 inch to 7·8 stat. miles. Sheet 30, Michipicoten, Ontario. Ottawa: Department of the Interior, Topographical Surveys Branch, 1910. *Presented by the Department of the Interior, Ottawa.*

United States. **Rand, McNally, & Co.**

Indexed county and railroad pocket maps: California, scale 1:1,140,480 or 1 inch to 18 stat. miles; Iowa, scale 1: 823,680 or 1 inch to 13 stat. miles; Montana, scale 1: 1,457,280 or 1 inch to 23 stat. miles; New York, scale 1: 570,240 or 1 inch to 9 stat. miles; North Dakota, scale 1: 1,330,560 or 1 inch to 21 stat. miles; South Dakota, scale 1: 1,330,560 or 1 inch to 21 stat. miles; Oklahoma, scale 1: 823,680 or 1 inch to 13 stat. miles; Virginia, scale 1: 887,040 or 1 inch to 14 stat. miles. Chicago and New York: Rand, McNally, & Co., [1910].

United States. **U.S. Department of the Interior.**

State of Washington. Compiled from the Official Records of the General Land Office and other sources. Scale 1: 760,320 or 1 inch to 12 stat. miles. Washington: U.S. Department of the Interior.

ARCTIC REGIONS.

Spitsbergen. **Holmsen.**

Skizze des Gebietes zwischen Belsund und Eisfjord (Süd-Spitzbergen). Nach Aufnahmen von Gunnar Holmsen. Scale 1: 275,000 or 1 inch to 4·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 36. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

PACIFIC OCEAN.

Bismarck Archipelago. **Sapper, Friederici, and Wernicke.**

Aufnahmen auf der Gazelle-Halbinsel, [Neu Pommern]. Von Prof. Dr Karl Sapper, Dr. G. Friederici, und W. Wernicke. Scale 1: 200,000 or 1 inch to 3·2 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 33. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Samoa. **Wegener.**

Die Samoa-Insel Savaii (Szavâii). Entworfen von Dr. Kurt Wegener. Scale 1: 150,000 or 1 inch to 2·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 37. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Shows contours at 100-metre intervals, lava-flows, and general character of surface features, with eight plans of harbours and landing-places as insets.

GENERAL.

World. **Bartholomew and Lyde.**

An Economic Atlas. By J. G. Bartholomew, LL.D. With an Introduction by L. W. Lyde, M.A. Oxford: The Clarendon Press, 1910. *Price* 3*s.* 6*d.* *Presented by the Publishers.*

The Oxford University Press, in response to requests, have published an edition of the Economic Atlas, noticed in the number of the *Geographical Journal* for last month, for other than school use. The introduction by Prof. L. W. Lyde has been modified, and the atlas is provided with a more substantial binding.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during March, 1910. *Presented by the Hydrographer, Admiralty.*

New Plans and Plans added—No. 1134, Gulf of St. Lawrence, Magdalen islands. Plan added: Entrance to Grand Entry harbour, 2*s.* New Editions—No. 3177, South Polar chart, 3*s.* 1241, Ice chart of the southern hemisphere, 3*s.* 6*d.* 3173, Antarctic ocean, sheet iv., 3*s.* 3206, Antarctic ocean, sheet viii., 3*s.* 2484, West Indies: Cartagena harbour, 3*s.* 21, Magellan strait: Second Narrows to Cape Pillar, 4*s.* 1130, China, south coast: Approaches to Hong Kong, 3*s.* 2385, Japan: Tsu sima, 3*s.* 2850, Australia, east coast: Double point to Cape Grafton, 3*s.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, May and June, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S. Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, May, 1910. London: Meteorological Office, 1910. *Price* 6*d. each.* *Presented by the Meteorological Office.*

Atlantic, South. **U.S. Hydrographic Office.**

Pilot chart of the South Atlantic Ocean, June, July, and August, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Atlantic, South. **U.S. Weather Bureau**

Meteorological chart of the South Atlantic Ocean, June, July, and August, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S. Weather Bureau.*

Indian Ocean. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean, May, 1910. London: Meteorological Office, 1910. *Price* 6*d. each.* *Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, May, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, May and June, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S. Weather Bureau.*

Pacific, South. **U.S. Weather Bureau.**

Meteorological chart of the South Pacific Ocean, June, July, and August, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S. Weather Bureau.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

INDEX.

* Denotes Articles and Papers. † Bibliographical Entry.
§ Reviews and Notices.

A.

Abbate Pacha, Île de Rodah, 345 †
Abella y Casariego, E., Descripción física, geológica y minera en bosquejo de la Isla de Panay, 218 †
Aboinia river, S. Nigeria, survey by J. Burn, 596
Abraham, G. D., British Mountain Climbs, 181 §,
Abruzzi, H.R.H. Duke of, Expedition to Karakoram, 330
Abshagen, G., Phytoplankton des Greifswalder Boddens, 349 †
Abu Habl, Khor, 256
Abu-Kimal, Mesopotamia, 13
Abu Moharik dunes, Libyan desert, 380
Abuna river, Bolivia, 523
Abyssinia—
  Charakterpflanzen des abessinischen Hochlandes: F. Rosen, 609 †
  Mission en Ethiopie: J. Duchesne-Fournet et H. Froidevaux, 436 §
Active Service pocket-book: B. Stewart, 739 †
Adamaua—
  Reise in Adamaua. Von Jolso nach Ngaumdere: E. Diesing, 95 †
Adamović, L., Vegetationsverhaltnisse der Balkanländer, 462 †
Adams, F., Photographs of Bolivia and Peru, 479 †
Adams, G. J., Geological Reconnaissance of Island of Leyte, 608 †
Adams, J., Distribution of Lichens in Ireland, 463 †
Adana—
  Trade of province of Adana, Report for 1908..94 †
Adelaide island, Antarctic, 599
Admiralty Charts, 103 †, 223 †, 355 †, 479 †, 619 †, 744 †
Admiralty Islands—
  Strafexpedition nach den Admiralitats-Inseln, 213 †
Adriatic—
  Flutwelle im Adriatischen Meere: R. v. Sterneck, 462 †
Afghanistan—
  Afghan Borderland: E. Huntington, 464 †
  Exploration in, 397
Afghanistan—*continued.*
  Leaves from Afghan scrap-book: E and A. Thornton, 711 §, 733 †
Africa—
  Africa and Australia: J B. Reynolds, 75 §
  Afrikas Wildkammern als Forscher und Jager: A. Berger, 466 †, 586 §
  Boundaries between British and German Territories in Africa, Treaty Series, 1909..96 †
  British East—
    Camera adventures in African wilds: A. R. Dugmore, 734 †
    Forests, Report on: D. E. Hutchins, 210 †, 315 §
    History, people, etc., S. Playne and F H. Gale, 166 †
    In Grip of the Nyika: J H Patterson, 187 §, 466 †
    Survey Dept Annual Report for 1909 ..609 †
    To Abyssinia through an unknown land. C. H. Stigand, 734 †
  Central—
    Afrique centrale a-t-elle été decouverte au XVI^e^ siecle?, A. J. Wauters, 344 †
    Fighting Slave-hunters in Central Africa. A. J. Swann, 734 †
    High plateau of, 143
    Vegetationsverhaltnisse der centralafrikanischen Seenzone: J. Mildbraed, 345 †
  Civilisations de l'Afrique du Nord. V. Piequet, 187 §, 211 †
  East—
    Frontier delimitations in British and German East Africa and Belgian Congo, 722
    Geografia dell' Africa orientale secondo le indicazioni dei monumenti egiziani: E. Schiaparelli, 609 †
    In Wildest Africa: P. MacQueen, 187 §, 345 †
    Native Life in East Africa: K. Weule, 210 †
  Flies, Blood-sucking, Illustrations of: E. E. Austen, 465 †
  French territory in Equatorial Africa, 333

Africa—continued.
French West—
Notice publiée par le Gouvernement Général à l'occasion de l'Exposition Franco-Britannique de Londres: G. François, 466 †
Région des sources du Niger: A. Chevalier, 610 †
German Colonies: Erforschungen, Erkundungen und Kämpfe in unsern afrikanischen Kolonien, 1907–08: C. Winkler, 466 †; Zwanzig Jahre in deutschen Kolonien: W. Langheld, 466 †
German East—
Goldvorkommen Deutsch-Ostafrikas: F. Tornau, 610 †
Reise durch die Deutschen Kolonien. Deutsch Ostafrika, 734 †
Reise in Ukonongo: E. Diesing, 346 †
Völkerstämme im Norden Deutsch-Ostafrikas: M. Weiss, 734 †
German South-West—
Botanische Forschungsreise nach dem Norden, 95 †
Desert land of, 503
Deutschen Diamantenlande: K. Schwabe, 467 †
Diamond deposits of Luderitzland: H. Merensky, 94 †
Diamond Fields, history, etc.: P. Range, 197
Expedition Streitwolfs nach dem Caprivi-Zipfel, 610 †
Namib nach Lüderitzbucht, Durch die: Hauptmanns v. Kappard, 346 †
Regenverhältnisse Deutsch-Südwestafrikas: R. Fitzner, 94 †
Search for "Bushmen's Paradise": Lieut. Trenk, 80
Wirtschaftsgeographischen Verhaltnisse des Caprivizipfels: F. Seiner, 467 †
Gramtes, Old, of Transvaal and of South and Central Africa: C. B. Horwood, 466 †
Innerste Afrika, Ins: A. F. Herzog zu Mecklenburg, 345 †, 437 §
Map of Africa by Treaty: Sir E. Hertslet and others, 325 §, 465 †
Maps—
Africa (G.S.G.S.), 477 †, 742 †
Afrique Equatoriale Française, Carte Général: G. Delingetti, 616 †
Atlante d'Africa: A. Ghisleri, 616 †
British East Africa, Uasin Gishu Plateau (G.S.G.S.), 353 †
Central and South Africa: J. G. Bartholomew, 352 †
Deutsch-Ostafrika: P. Sprigade, 478 †
Deutsch-portugiesischen Grenze Zwischen dem oberen Rowuma und dem Njassa: Major Schlobach und M. Moisel, 477 †
Deutsch-Südwestafrika: P. Sprigade und M. Moisel, 478 †; Diamant-

Africa—continued.
Maps—continued.
Fundstellen in, nach dem gegenwärtigen Stande der Kenntnis: O. Quelle, 353 †; Marmorvorkommen in: G. Gürich, 617 †
Tropical Africa, showing distribution of Tsetse Flies and Sleeping Sickness, 477 †
Mollusques d'Afrique, Conclusions d'ordre géographique tirées de l'étude des: P. Lemoine, 466 †
North—
Civilisations de l'Afrique du Nord. V. Piquet, 187 §, 211 †
Klimaänderung während geschichtlicher Zeit in Nordafrika: H. Leiter, 468 †
Pflanzenbarren der Afrikanischen Flüsse: O. Deuerling, 184 §, 210 †
Portuguese West Africa, Labour in W. A. Cadbury, 588 §, 735 †
Railway Construction in South Central Africa, 334
South—
Agriculture and Viticulture in South Africa, Report on: Lord Blyth, 735†
Archæology and geology in S. Africa, Intimate relations between: W Anderson and G. H. Stanley, 211 †
Discoveries of economic importance made by Albany pioneers: E. H. L Schwarz, 96 †
Fauna of, 132
Guide to S. Africa: A. S. and G. G. Brown, 468 †
History of South Africa since 1795: G. McCall Theal, 735 †
Irrigation in, 334; Proceedings of First South African Irrigation Congress, 1909..468 †
Kapland, insonderheit das Reich der Kapflora, das Waldgebiet und die Karroos: R. Marloth, 211 †, 711 §
Oro deposits of S. Africa: J. P. Johnson, 188 §, 211 †
South Africa (Romance of Empire Series): I D. Colvin, 68 §
South Africa from Great Trek to Union: F. R. Cana, 211 †, 326 §
Trek in Unknown Country North of Makalakari: A. W. Hodson, 609 †
Union of S. Africa: Hon. R. H. Brand, 188 §, 211 †
South-West—
Percy Sladen Memorial Expedition in South-West Africa, 1908–09. H. H. W. Pearson, 735 †
Phytogeography of, 482
Travels of a Botanist in: H. H. W. Pearson, 481 *
Tropical—
Forêt vierge de l'Afrique tropicale Extension et régression de la: A. Chevalier, 468 †
Tourbières de rochers de l'Afrique tropicale: A. Chevalier, 468 †

Africa—*continued.*
West—
Afrique Occidentale au Temps des Antonins: R. Avelot, 79 §, 211 †
Alte und neue Handelsstrassen in West-Afrika: D. Kürchhoff, 469 †
Land of Golden Trade: J. Lang, 469 †, 567 §
Ptolemy's knowledge of: R. Avelot, 79
Sanitary Matters in various West African Colonies, Report on: W. J. Simpson, 211 †
Von der Yola-Crosssehnellen Grenzexpedition, 469 †
Vorläufige ethnographische Ergebnisse der Deutschen Innerafrikanischen Forschungsexpedition 1907–09: L. Frobenius, 468 †
West Coast of Africa, Contributions to determination of geographical positions on: C. Sanders, 344 †
Wildest Africa, In: P. MacQueen, 187 §, 345 †
Agassiz, A., obituary, 602
Agriculture—
New Exploration of World: D. Fairchild, 349 †
Aguapehy, Rio—
Exploracão dos Rio Feio e Aguapehy. G. Moura, 328 §
Air: *see* Meteorology
Air, Oasis of—
Touarag du Sud-Est; L'Air: C. Jean, 186 §
Aitken, P. H.: *see* Young, J.
Aktash glacier, Karakoram, 647, 651
Alaska—
Boundary, Marking the Alaskan: T. Riggs, 96 †
Economic Evolution of Alaska: A. W. Greely, 96 †
Fortymile quadrangle: L. M. Prindle, 469 †
Handbook of Alaska: A. W. Greely, 69 §, 96 †
Maps: Alaska (U.S. Dept. of Interior), 742 †
Mineral Resources: A. H. Brooks and others, 469 †
Mineral Resources of Kotsina-Chitina Region: F. H. Moffit and A. G. Maddren, 469 †
Monarchs of Alaska: R. H. Sargent, 96 †
Northern Alaska in Winter: V. Stefánsson, 469 †
Surface Features of Northern Alaska: T. S. Solomons, 96 †
Water-Supply Investigations in Yukon-Tanana Region: C. C. Covert and C. E. Ellsworth, 346 †
Yakutat Bay Region. Physiography and Glacial Geology: R. S. Tarr. Areal Geology: R. S. Tarr and B. S. Butler, 610 †; Some phenomena of Glacial margins in: R. S. Tarr, 346 †
Albania—
Adria zum Schwarzen Drin, Von der: K. Steinmetz, 462 †
High Albania: M. E. Durham, 208 †, 322 §
Nordalbanischen Hochgebirge, Aus dem: E. Liebert, 462 †
Skutari und die nordalbanische Kustenebene: T. A. Ippen, 343 †
Alberta, Wheat production, 54
Alexandria—
Terrestrial Refraction at Alexandria: C. Xydis, 79 §, 99 †
Algeria—
Maps—
Carte des Voies de Communication (Gouvernement Gen. de l'Algérie), 102 †
Frontière Algero-Marocaine (Service Géo. de l'Armée), 742 †
Verwitterung und Abtragung in den Steppen und Wüsten Algeriens. S. Passarge, 344 †
Ali Bransa, Karakoram, 628
Alldridge, S. J., A transformed Colony: Sierra Leone as it was and as it is, 735 †
Allen, B. C., Assam District Gazetteers. Khasi and Jaintia Hills 464 †
Almagia, R., Geografia fisica in Italia nel Cinquecento, 732 †
Almanack—
Fisherman's Nautical Almanack, etc: O. T. Olsen, 474 †
Alone, J. P., Short manual of Amharic language, 733 †
Alps—
Aufnahmen am Nord- und Ostrand des Hochalmmassivs, Bericht über die: F. Becke, 341 †
Eiszeitliche Vergletscherung der Bösensteingruppe in den Niedern Tauern L. Hauptmann und F. Heritsch, 340 †
Glacial erosion, E. de Martonne's researches, 338
Glaciers of, 280
Limite climatico delle nevi nel gruppo del M. Canin (Alpi Giulie): O. Marinelli, 341 †
Photographs. Vue des Alpes avec mer de brouillards prise du Chasseron. A. Vautier-Dufour, 104
Rhein-Rhone-Wasserscheide, Entwickelung der: E. Brückner, 462 †
Schneedichtebestimmungen auf dem Hohen Sonnblick: A. Defant, 462 †
Taltröge in den Alpen, Frage ineinander geschalteter: H. Crammer, 340 †
Unterirdisch entwässerte Gebiete in den nördlichen Kalkalpen: M. Hoffer, 88 †
Vegetationsstudien in den Ostalpen: G. R. Beck, 341 †
Verkehrswege über die Alpen: F. Meinhard, 340 †
Alt, E., Doppeloszillation des Barometers insbesondere im arktischen Gebiete,

214 †: Geographische Verteilung der Gewitter-Häufigkeit in Kontinental- und Nord-europa, 382 †
Altai—
Glacial-Periode im Altai, Zur Frage über die: P. P. Pilipenko, 94 †
Journey in Mongolian Altai by V. V. Sapeshnikoff, 195
Altitude and azimuth tables for facilitating determination of lines of position at sea: R. de Aquino, 472 †
Altitudes—
Trigonometrische Höhenmessung . . . in der Nähe des Meeresspiegels: F. R. Helmert, 215 †
Amazon—
Across a continent in a man-of-war: E. E. Higbams, 213 †
Expedition in Amazon Basin: T. W. Whiffen, 454
Maps: Carte du cours de l'Amazone: P. Le Cointe, 742 †
Rubber forests of, 516
Amdrup, G., Carlsbergfondets Expedition til Ost-Grønland, 98 †; Ethnological description of Amdrup collection from E. Greenland: W. Thalbitzer, 98 †
America—
Hard Woods of the Americas—Quebracho, 349
America, North—
Atlantic Forest Region: S. Trotter, 611 †
Camps and cruises of an ornithologist: F. H. Chapman, 212 †
Floods in Great Interior Valley: L. A. Owen, 56 *
Pre-Cambrian Geology: C. R. Van Hise and C. K. Leith, 346 †
Verrazzano's Voyage of 1524: A. Bacchiani, 428
Waterways, American inland: H. Quick, 470 †
Wheat Culture, Development of: A. P. Brigham, 42 *
America, South—
Antiquités de la région andine, etc.: E. Boman, 471 †
Expeditions, 335
Insect pests, 519
Lagos de los altiplanos de la América del Sud: M. Neveu-Lemaire, 471 †
Photographs: P. H. Fawcett, 480 †; F. G. Fisher, 619 †
Stanford's Compendium of Geography and Travel. Central and South America: A. H. Keane and Sir C. R. Markham, 69 §
Americanists, Seventeenth Congress of, 602
Amhâric language, Short manual of: J. P. Alone, 733 †
Ammo-chhu Bhutan, 32
Ampferer, O., Ueber die Entstehung der Inntal-Terrassen, 340 †
Amundsen, R., North Polar Expedition, 201; Plan for an Polarfaerd 1910-17.. 612 †
Anau—
Explorations in Turkestan. Prehistoric Civilisations of Anau: B. Pumpelly, 61 §
Anderson, E. M., On Temperature Gradients of Deep Bores, etc., 613 †
Anderson, W., and G. H. Stanley, On intimate relations between archæology and geology in South Africa, 211 †
Andersson, G., Climate of Sweden in Late Quaternary Period, 90 †
Andes—
Bau der argentinischen Anden, Ueber den: H. Keidel, 97 †
Expeditions, F. Reichert's, 336
Lagos de los altiplanos de la América del Sud: M. Neveu-Lemaire, 471 †
Physiography of Central Andes. I. Bowman, 347 †
Andres, L., Längenunterschiedmessungen zweiter Ordnung, 215 †
Anglo-Egyptian Sudan: *see* Sudan
Angola—
Geographical positions on west coast of Africa, Contributions to determination of: C. Sanders, 344 †
Trade of, Consular Report for 1908: Mr Mackie, 72
Annam—
Exploration, French, in Cambodia and Annam: H. Maître, 593
Anson's voyage round the world, 1740 1744: C. G. Cash, 192 §, 217 †
Antarctic—
Eisformen und Vergletscherung der antarktischen Gebiete: O. Nordenskjold, 214 †
Expeditions—
British: W. S. Bruce's, 600; J Charcot's, 337, 599; R. F. Scott's, 83, 201; National Expedition Magnetic observations, 471 †
German. Deutsche Südpolar Expedition 1901-1903: E. v. Drygalski, 98 †; Proposed expedition under Lieut. Filchner, 455, 600
Swedish: Klima als eine Funktion von Temperatur und Windgeschwindigkeit in ihrer Verbindung. G. Bodman, 441 §; Meteorologische Ergebnisse der Schwedischen Südpolar-Expedition. Stündliche Beobachtungen bei Snow Hill: G. Bodman, 440 §
United States: U.S. Department of Commerce and Labour proposed expedition, 338; Proposed American expedition to Wilkes Land, 338
Heart of Antarctic: E. H. Shackleton, 214 †
Maps; Antarktische Festland: O Meinardus, 222 †
Shackleton e la questione antartica: A. Faustini, 471 †
Shelf-ice of Antarctic: E. Philippi, 725
Südpolarkontinentheorie nebst Bemerkungen über tiergeographische Ver-

Antarctic—*continued.*
hältnisse auf der Südhemisphäre: H. Kolbe, 471 †
Wilkes Land, Why America should re-explore: E. S. Balch, 338, 471 †
Anthropogeography—
Anthropogeography of some Great Cities: M. Jefferson, 349 †
Anticosti—
Colonisation de l'île d'Anticosti: M. Dewavrin, 610 †
Antiscyclonic belt of Northern hemisphere: H. E. Rawson, 613 †
Antiquary's life, Accidents of an: D. G. Hogarth, 739 †
Ants, Termites and Driver, Northern Rhodesia, 139
Apsheron Peninsula, Physical Geography of: P. Volarovich, 195
Aquino, R. de, Altitude and azimuth tables for facilitating determination of lines of position at sea, 472 †
Arab—
Kultur der Araber: J. Hell, 473 †
Araba, Wadi, 596
Arabia—
Journey in North-Western Arabia: D. Carruthers, 225 *
Nord-Arabien, Vorbericht über die Forschungsreise 1908-9: A. Musil, 464 †, 579 §
Rivers and Rainfall, 246
Aral—
Aralsee und sein Gebiet nach den neuesten Forschungen: A. Wocikow, 94 †
Archangel—
Province d'Arkhangelsk: P. Labbé, 90 †
Archer, R. L., and others, Teaching of Geography in Elementary Schools, 739 †
Archer, W., Through Afro-America, 736 †
Arctic—
Canadian Arctic Archipelago, Captain Bernier's Expedition in, 81
Danmark-Expedition 1906-08, Drachen und Fesselballonaufstiege ausgeführt auf der: A. Wegener, 612 †
Doppeloszillation des Barometers insbesondere im arktischen Gebiete: E. Alt, 214 †
Expeditions: Amundsen's, 201
Ice in Arctic Seas during 1909, Report by Danish Meteorological Institute, 725
Nordpolarforschung, Ziele und Erfolge der: O. Baschin, 472 †
Océan glacial et en Nouvelle-Zemble, Dans: C. Bénard, 738 †
Peary and Cook's Narratives, 200
Peary Expedition, Report by Committee of National Geographic Society, 82
Plan for en Polarfærd 1910-17: R. Amundsen, 612 †
Plea for British Arctic Expedition: A. H. Harrison, 214 †
Arctic—*continued.*
Polarvölker: A. Byhan, 472 †
Pôle Nord, Le Dr. Frederic Cook au, 214 †
Russische Polarfahrt der *Sarja*, 1900-1902, aus den hinterlassenen Tagebüchern von Baron Eduard von Toll: Baronin Emmy von Toll, 71 §
Temperature, Lowest, on Earth's Surface, 98 †
Voyages et découvertes faites par les Russes le long des côtes de la Mer Glaciale, etc.: G. P. Muller, 229 †
Ard-es-Suwan, Arabia, 232
Argentine—
"Escorias" y "tierras cocidas" de la serie pampeana de la República Argentina, Estudio de las supuestas: F. F. Outes and others, 611 †
Etnologia Argentina: S. A. Lafone Quevedo, 347 †
Excursión arqueológica á las ruinas de Kipón: S. Debenedetti, 97 †
Frontéra Argentino-Chilena. Demarcación General 1894-1906..588 §
Observaciones Arqueológicas sobre Alfareria Funeraria de la "Poma": J. A. Willenius, 347 †
Regiones físicas de la República Argentina. E. A. S. Delachaux, 598 §, 611 †
Tipos de Alfareria en la region Diaguito-Calchaqui: S. A. Lafone Quevedo, 347 †
Argyllshire—
Geology of the Seaboard of Mid-Argyll, etc.: B. R. Peach and others, 463 †
Ariare river, Brazil, 681
Arizona—
Weather Cycles in Growth of Big Trees: A. E. Douglass, 335 §, 611 †
Armenia—
Maps: Tektonische Uebersichtskarte Armeniens: F. Oswald, 352 †
Arnold, C., and F. J. T. Frost, American Egypt; record of travel in Yucatan, 189 §, 212 †
Arnold, J. H., Ascent of Mount Morrison, 93 †; Peoples of Formosa, 344 †
Arnost Meleto range, Kurdistan, 358, 360
Arosemena, C. C.: *see* Cortes, E.
Artaria's Eisenbahnkarte von Österreich-Ungarn mit stationsverzeichnis, 220 †
Ascoli, W. S., Guatemala Earthquake and Eruption of 1902..213 †
Ashton, W., Battle of land and sea on Lancashire, Cheshire, and North Wales Coasts, 732 †
Asia—
Central—
Central Asian archæology, 61
Climatic Study in Central Asia, 405, 411
Exploration géographique et archéologique en Asie centrale (1906-1908): A. Stein, 464 †
Geographische und archäologische

Asia—*continued.*
Central—*continued.*
Forschungsreisen in Zentralasien 1906–1908..M. A. Stein, 343 †
Glaciation of, 410
Human Life, Distribution of Modes of, 418
Kunstliche Berieselung in Inner-Asien und die Völkerwanderung: J. v. Cholnoky, 343 †
Lake Deposits and Old Strands, 405
Life in Great Desert: E. Huntington, 210 †
Migrations in, 417
Mission Pelliot en Asie Centrale, 209 †, 594 §
Mountain problems of, 400
Problems in Exploration: E. Huntington, 395 *
Rivers, Changes in, 408
Sand-dunes and Aeolian Action, 408
Terrestrial Magnetism problems, 404
Watershed, 655
Far East, A Scamper through: H. H. Austin, 184 §, 209 †
Mantle of the East: E. Chandler, 738 †
Maps—
Carte de l'Asie (Service Géog. de l'Armée), 616 †
Eisenbahnbauten im russisch-japanisch-chinesischen Grenzgebiet Ostasiens: Major Toepfer, 616 †
Physical School-map of Asia (Survey Dept., Cairo), 477 †
Southern Frontier Regions of Asiatic Russia (Military Top. Dept.), 616 †
Uebersicht der Reisewege von Dr. Gyula Prinz in Mittelasien 1909.. 352 †
Overland trek from India by side-saddle, camel, and rail: E. F. Benn, 183 §, 210 †
Oxford Geographies. Vol. 4, Asia: F. D. Herbertson, 209 †, 716 §
Polemy's geography of Eastern Asia, Researches on: G. E. Gerini, 733 †
Russian Central: Niveau des lacs de l'Asie Centrale russe, etc., J. de Schokalsky, 608 †; Schluchten auf dem Plateau Ischokusu: A. Ivchenko, 210 †
Scientific Geography. Book VI. Asia: E. W. Heaton, 76 §
Asia Minor—
Thousand and One Churches: Sir W. M. Ramsay and G. L. Bell, 465 †, 583 §
Asiatic languages—
System for transliteration of Persian, Afghan, and Arabian words, 92 †.
Askja volcano and lake, Iceland, 78, 321
Aso Volcano—
Altitude Measurements in Aso Volcano: S. Nakamura and C. Hiratsuka, 93 †
Eruption of Aso Volcano, Recent State of: J. Iwasaki, 93 †
Cooch Behar, the Duars and Assam, Thirty-seven Years of Big Game shooting in: Maharajah of Cooch Behar, 184 §, 209 †
District Gazetteers. Khasi and Jaintia Hills: B. C. Allen, 464 †
Assyrian people, 362
Asulkan glacier, Selkirks, 281
Aswan dam, Nile, 426
Atacama, Puna de, 588
Atlantic—
Currents flowing to North sea, 433
Ergebnis der Versuche mit dem Bezuge von Wetter-Funkentelegrammen vom Nordatlantischen Ozean: L. Grossmann, 613 †
Evaporation in S. Atlantic, Observations on: R. Lütgens, 84
Exploration internationale de l'ocean Atlantique, Programme pour l'. S. Marini, 216 †
Magnetic Results obtained on *Carnegie* in North Atlantic: L. A. Bauer and W. J. Peters, 473 †
Maps—
Meteorological Charts of North and South Atlantic Ocean (U.S. Weather Bureau), †103, 223, 355, 479, 744; Meteorological Charts of North Atlantic and Mediterranean (Met. Office, London), †103, 223, 355, 479, 619, 744; Pilot Charts of North and South Atlantic (U.S. Hydrog. Office), † 103, 223, 355, 479, 619, 744
Scientific and Biological Researches in North Atlantic: R. N. Wolfenden, 216 †, 442 §
Atlas mountains—
Geological researches by M. Gentil, 722
Atlases—
Atlas Colonial Português, 223 †
Atlas Universel de Géographie: V. de St. Martin et F. Schrader, 103 †
Economic Atlas: J. G. Bartholomew and L. W. Lyde, 744 †
Formæ Orbis Antiqui: H. Kiepert, 354 †
Geographisch-Statistischen Universal-Taschen-Atlas: A. L. Hickmann, 351 †
Geographischer Volksschul Atlas: J. G. Rothaug, 355 †
Grosser deutscher Kolonialatlas: P. Sprigade und M. Moisel, 222 †
Handy Royal Atlas of Modern Geography: A. K. Johnston, 618 †
List of Geographical Atlases in Library of Congress: P. L. Phillips, 430 §
School Economic Atlas: J. G. Bartholomew and L. W. Lyde, 618 †
World-wide Atlas of Modern Geography: W. & A. K. Johnston, 354 †
Atmosphere: *see* Meteorology
Atmospheric Electricity Observations made on Magnetic Survey Yacht *Galilee*, 1907–08, Report on: P. H. Dike, 215 †
Aubin, E., En Haïti, 737 †

Austen, E. E., Illustrations of African blood-sucking flies, 465 †
Austin, H. H., A Scamper through Far East, 184 §, 209 †
Australasia—
Maps: "Lady Northcote" Atlas of Australasia: H. E. C. Robinson, 354 †
Australia—
Africa and Australia: J. B. Reynolds, 75 §
Arid regions, 663
Artesian wells, 680
Capital of Australian Commonwealth, 318
Economic Resources, 665
Geographical Factors that Control Development of Australia: J. W. Gregory, 658 §
Handbook of Australia, 471 †
Interior and Marginal Zone, Contrast between, 660
Maps: Plans of Locations of Land open for Selection in Avon, Nelson, and Plantagenet Districts, W.A. (Dept. of Lands and Surveys), 618 †
Mining industries, 665
Pastoral industries and produce, 665
Population and aborigines, 666, 667, 678
Rainfall of Australia: J. Barling, 471 †
Solar Physics Committee; Discussion of Australian Meteorology: W. J. S. Lockyer, 70 §
South—
Geological Observations on some of Localities visited by "Governor Musgrave" Party in 1907: W. Howchin, 98 †; North-western District of: J. Bonnin, 98 †
Tropical colonization, Problem of, 669
Water-supply, 663
Western: Geological Features of Country along Route of proposed Transcontinental Railway: C. G. Gibson, 738 †
Austria—
Klimatographie von Österreich (K. K. Zentralanstalt für Meteorologie und Geodynamik), 447 §
Maps—
Befestigungen der österreichisch-italienischen Grenze, 352 †
Österreichischen Alpenländer: J. G. Rothaug, 350 †
Politischen Bezirkes Hietzing-Umgebung: G. Freytag, 614 †
Politischen Bezirke Melk und Scheibbs: Freytag and Berndt, 350 †
Schi-Routenkarte der Niederösterreichisch-Steirischen Kalkalpen und des Oberen-Ennstales: G. Freytag und H. Gragger, 350 †
Schulwandkarte des Herzogtums Schlesien: R. Kober, 350 †
Schulwandkarte des politischen Bezirkes Horn: G. Freytag und Berndt, 350 †
Austria-Hungary—
Austria-Hungary: G. Drage, 179 §
Maps—
Artaria's Eisenbahnkarte von Österreich-Ungarn mit Stationsverzeichnis, 220 †
Dislokationskarte des k. u. k. österr.-ungar. Heeres, der Landwehren und Gendarmeriekorps: G. Freytag, 615 †
Geographisch-Statistischer Taschen-Atlas von Österreich-Ungarn: A. L. Hickmann, 350 †
Meer- und Hafenfernen von Oesterreich-Ungarn: J. Kiesewetter, 740 †
Spezialkarte der österreichisch-ungarischen Monarchie, 220 †
Verkehrskarte von Österreich-Ungarn mit den Balkanländern: G. Freytag, 350 †
Avaria, L. N., Censo Jeneral de Poblacion . . . del Territorio de Magallanes, 589 §
Avebury—
Guide to Avebury and neighbourhood R. H. Cox, 321 §
Avelot, R., Afrique Occidentale au Temps des Antonins, 79 §, 211 †
Avon and Don rivers, Banffshire, Case of River Capture: A. W. Gibb, 446
Aymé-Martin, —, Chemins de fer du Laos, 607 †
Azrak, Wadi el, Kordofan, 256

B.

Bacchiani, A., Verrazzano's voyage of 1524..428
Bacot, J., Dans les marches tibétaines. Autour du Dokerla (1906–1908), 464 †, 586 §; Travels in China-Tibetan Frontier, 595
Baden—
Bevölkerung des Grossherzogtums Baden: H. Pfeiffer, 89 †
Baedeker, K., Great Britain. Handbook for travellers, 732 †
Baffin's Land, Eskimo of, 296
Bagdad—
Bagdadbahn und der Gülek Boghas im Taurus: A. Janke, 94 †
Baggara tribe, Kordofan, 261
Bahr-el-Ghazal—
Photographs of: H. Channer, 101 †
Survey work in, 539
Bahr-el-Jebel, Sadd-blocks of, 185
Baines, Sir J. A., Recent growth of population in Western Europe, 607 †
Baku—
Geology of Baku and European Oilfields, Sketch of: L. V. Dalton, 89 †
Balaton, Lake—
Eis des Balatonsees: E. von Cholnoky, 89 †
Balch, E. S., High Mountain Ascents, 100 †; Why America should re-explore Wilkes Land, 471 †

Baldacci, G., Promontory of Capo Guardafui, 467 †
Balearic islands—
Archipel des Baléares: E. Gallois, 90 †
Balkan peninsula—
Karst und Karsthydrographie: F. Katzer, 207 †
Maps: Generalkarte von Dalmatien, Bosnien und der Hercegovina: G. Freytag, 740 †
Vegetationsverhältnisse der Balkanländer: L. Adamović, 462 †
Ball, J., Origin of Nile Valley and Gulf of Suez, 596 §, 609 †
Ballivián, A., Delegación Nacional del Territorio de Colonias del N.O., Bolivia, 1908..97 †; El laudo Argentino; inaceptable para Bolivia, 212 †
Baltic—
Hydrographische Untersuchungen im nördlichen Teile der Ostee, etc., 1898–1904: R. Willing, 180 §
Phytoplankton des Greifswalder Boddens: G. Abshagen, 349 †
Baluchistan—
Geology of Sarawan, Jhalawan, etc., Report on: E. W. Vredenburg, 593 §, 607 †
Bampfylde, C. A.: *see* Baring-Gould, S.
Banda—
Drie buiteneilanden der Banda-Groep: H. P. T. Witkamp, 608 †
Bande country, Liberia, 285–294
Bangweulu, Lake, Rhodesia, 141
Banks, Sir J., Father of Australia: J. H. Maiden, 474 †
Banse, E., Der Orient, eine Länderkunde, 739 †; Syrische Fragmente, 608 †
Barchans, or crescentic dunes, Libyan desert, 386, 392
Barclay, W. S., remarks on "Explorations in Bolivia," 531
Baring-Gould, S., and C. A. Bampfylde, History of Sarawak under its two white Rajahs, 344 †
Barker, J. E, Great and Greater Britain, 181 §, 217 †
Barling, J., Rainfall of Australia, 471 †
Barometer manual for use of seamen, 613 †
Barré, H., Répartition des originaires des Bouches-du-Rhône dans les autres départements, 89 †
Bartet, A., Rois du Bas-Dahomey, 346 †
Bartholomew, J., Contoured map of Environs of London, 351 †; "Quarter-Inch-to-mile" map of Scotland, 615 †; Plan of Dublin, 351 †; Reduced survey map of British Isles, 740 †
Bartholomew, J. G., An Economic Atlas, 744 †; Central and South Africa (Map), 352 †; Plan of Norwich based upon Ordnance Survey Map, 740 †; and L. W. Lyde, School Economic Atlas, 618 †
Baschin, O., Bibliotheca Geographica, 100 †; Ziele und Erfolge der Nordpolarforschung, 472 †
Bastin, E. S., and C. A. Davis, Peat Deposits of Maine, 97 †
Basutoland—
Basutos: mountaineers and their country: Sir G. Lagden, 468 †
Baudon, M. A., De Brazzaville à Franceville, 94 †
Bauer, L. A., Earliest Values of Magnetic Declination, 473 †; and W. J. Peters, First Magnetic Results obtained on *Carnegie* in North Atlantic, 473 †
Baughan, B. E., Finest Walk in the World, 612 †
Bayberger, F., Zum Problem des Wellheimer Trockentals, 730 †
Bayer, Wells and ruined Khan of, 243
Bayley, G. D., Handbook of British Guiana, 1909..346 †.
Bayley, W. S.: *see* Clapp, F. G.
Beadnell, H. J. L., Sand-dunes of Libyan Desert, 379 *
Beak, G. B., Aftermath of war, 735 †
Bear, Grizzly: W. H. Wright, 190 §
Beaumont, Sir L., remarks on "Notes on Determination of Position near the Poles," 304
Becerra, M., Région des Guelaya (Rif), 467 †
Beck, G. R., Vegetationsstudien in den Ostalpen, 341 †
Becke, F., Bericht über die Aufnahmen am Nord- und Ostrand des Hochalmmassivs, 341 †
Beckett, A., Spirit of the Downs, 732 †
Bedfordshire—
Water Supply from underground sources: H. B. Woodward and Thompson, 91 †
Begg, J. S., Influence of Topographical Conditions upon Climate in East of Scotland, 463 †
Béguinot, A., Vegetazione delle isole liguri di Gallinaria . . . e Tinetto, 90 †
Behrmann, W., Kritik der flächentreuen Projektionen der ganzen Erde und einer Halbkugel, 472 †
Belgium, King Leopold of, obituary, 202
Belgium, Prince Albert of, La traversée du Congo Belge, 344 †
Belgium—
Maps: Atlas des Villes de la Belgique au XVI^e siècle: J. de Deventer, 351 †; Carte Officielle des Chemins de Fer de la Belgique, 1908..351 †
Mouvement Scientifiques en Belgique 1830–1905. Sciences Géographiques: J. Mees, 88 †
Belka country, 227
Bell, G. L. (*see also* Ramsay, Sir W. M.), remarks on "Mesopotamia, Past, Present, and Future," 16
Bell, J. M., Physical Features of New Zealand, 612 †
Belloc, H., Historic Thames, 322 §, 464 †; Pyrenees, 582 §
Benadir, Il: V. Mantegazza, 734 †

Bénard, C., Dans l'océan glacial et en Nouvelle-Zemble, 738 †
Benedict, F.: *see* Graesse, J. C. T.
Beni Sakhr tribe, Arabia, 227
Benn, E. F., An Overland Trek from India, 183 §, 210 †
Bennet island, Arctic ocean, 72
Berchou, C., Conférences sur l'Ile de Cuba, 213 †
Berger, A., In Afrikas Wildkammern als Forscher und Jäger, 466 †, 586 §
Bergon, P., et F. Lalesque, Preuves géologiques et biologiques de l'origine marine du lac de Canaux, 341 †
Bering Sea, Cruises on: P. Niedeck, 614 †
Berkusky, H., Zur Anthropogeographie und Wirtschaftsgeographie der Philippinen, 465 †
Bern—
Beschreibung der Stadt und Republik Bern, 219 †
Bernacchi, L., remarks on "Notes on Determination of Position near the Poles," 308
Bernese Oberland: W. A. B. Coolidge, 181 §
Bernier, J. E., Expedition in Canadian Arctic archipelago, 81
Beveridge, A. S., Babar-nama Description of Farghana, 608 †
Beverley, W. H., Central and Eastern Provinces of Southern Nigeria, 1910 (Map), 617 †
Bhamo—
Von Bhamo nach Tengyuë. F. Weiss, 465 †
Bhutan—
Agriculture and irrigation, 39
Geographical position, 31
Geology, botany, and zoology, 38
History, 34
Journeys in Bhutan: J. C. White, 18 *
Mountain system, 31
People and industries, 35, 36
River system, 32
Sikhim and Bhutan: J. C. White, 182 §, 210 †
Vegetation and scenery, 33
Biafo-Hispar watershed peak, Himalayas, 112–115
Bibliographer's Manual of English literature: W. T. Lowndes, 219 †
Bibliographie Géographique Annuelle, 1908: L. Raveneau, 474 †
Bibliotheca Geographica: O. Baschin, 100 †
Bigelow, F. H., Studies on phenomena of evaporation of water over lakes and reservoirs, 83 §, 99 †
Bighorn mountains of Wyoming, Glaciation in, 153, 155
Bilafond glacier, Karakoram, 626, 627
Bingham, H., Cuzco and Sacsahuaman, 737 †; Journal of Expedition across Venezuela and Colombia, 191 §; Photographs of Vieques, Porto Rico, etc., 620 †
Binn—
Vallée du Binn (Valais), étude géographique, etc.: L. Desbuissons, 208 †
Bird, W. D., Some Principles of Frontier Mountain Warfare, 192 §
Birkinbine, J., Mixteca country in State of Oaxaca, Mexico, 346 †
Bismarck archipelago—
Ozeanographische Arbeiten S.M.S. *Planet* im Bismarck-Archipel, 1907.. 216 †
Bison—
Study of Wood Bison, North-West Canada: H. V Radford, 596
Blair, W. R., Exploration of Upper Air by means of Kites and Balloons, 614 †
Blanchard, R., Habitation en Queyras, 89 †
Blasneck, M. F., Neuseeland, 191 §
Blumer, J. C., On Plant Geography of Chiricahua Mountains, 611 †
Blyth, Lord, South Africa. Report on Agriculture and Viticulture in South Africa, 735
Bodman, G., Das Klima als eine Funktion von Temperatur und Windgeschwindigkeit in ihrer Verbindung, 441 §, Meteorologische Ergebnisse der Swedischen Südpolar-Expedition, 440 §
Boeseken, M. J. H., Het uitdrogingsproces der aard-oppervlakte, 472 †
Bogle, J. du T.: *see* Middleton, E.
Bogoras, W., Jesup North Pacific Expedition, vol. 7, The Chukchee, 210 †
Bolivia—
Boundary between Bolivia and Brazil, Survey work on: P. H. Fawcett, 163 *
Boundary between Peru and Bolivia Treaty of 1909 .597
Cuestiones Económicas y Financieras, 347 †
Delegación Nacional del Territorio de Colonias del N.O., Bolivia, 1908: A Ballivián, 97 †
El laudo argentino: inaceptable para Bolivia, inconveniente para el Perú A. Ballivian, 212 †
Explorations in Bolivia: P. H Fawcett, 513 *
Frontiers of, 524
Highland Dweller of Bolivia: I. Bowman, 347 †
Insect pests of, 519
Maps—
Endgiltige Linienführung der neuen Grenze zwischen Peru und Bolivien, 354 †
Reisewege in Ost-Bolivien: T. Herzog, 618 †
Photographs of Bolivia and Peru F. Adams, 479 †
Railways, 531
Bologna, its history, antiquities, and art: E. E. C. James, 462 †
Boman, E., Antiquités de la région andine, etc., 471 †

Bompas, C. H., Folklore of Santal Parganas, 184 §, 343 †
Bonin, C. E., Chemin de fer du Hedjaz, 608 †
Bonin islands—
Pflanzengeographische Studien über die Bonin-Inseln: H. Hattori, 93 †
Bonnin, J., North-western District of South Australia in September, 1862.. 96 †
Bores—
Temperature Gradients of Deep Bores: E. M. Andersson, 613 †
Borneo—
Maps: Overzichtskaart van het eiland Borneo (Top. Bureau, Batavia), 101 †
Bornholm—
Morphologie von Bornholm: G. Braun, 89 †, 193 §, 341 †
Bornu—
Overweg's grave in Bornu, Finding of: W. P. Hewby, 450
Bosnia—
Annexion de la Bosnie et la question Serbe: J. Cvijić, 88 †
Bosnia and Herzegovina, some wayside wanderings: M. M. Holbach, 182 §, 207 †
Maps: Generalkarte . . . von Bosnien u. Hercegovina: G. Freytag, 615 †
Bosporus—
Origin of Bosporus and Hellespont: R. Hoernes, 448
Bothnia, Gulf of, Hydrographical work in, 180
Bougainville, L. A. de, monument at Tahiti, 200
Bougainville island, Soundings in neighbourhood of, 82
Bourdariat, A., et Johnston-Lavis, H., Note sur le remarquable volcan de Tritriva, 95 †
Bourdillon, Sir J., remarks on "Journeys in Bhutan," 40
Bourgeois, H., Notes sur l'Orographie . . . et l'Administration du Turkestan Oriental, 93 †
Bouvet island—
Gesteine von der Bouvet-Insel, etc.: R. Reinisch, 348 †
Wiederauffinden der Bouvet Insel durch die deutsche Tiefsee-Expedition: W. Sachse, 348 †
Bowman, I., Highland Dweller of Bolivia, 347 †; Physiography of Central Andes, 347 †
Boyce, Sir R., Mosquito or Man? 349 †, 445 §
Bradley, A. G., Cambridge County Geographies. Wiltshire, 209 †
Bradley-Birt, F. B., Through Persia from Gulf to Caspian, 183 §
Brahmaputra—
Sand-drift in valley, 323
Brand, Hon. R. H., Union of South Africa, 188 §, 211 †
Brandenburg—
Landeskunde der Provinz Brandenburg: E. Friedel und R. Mielke, 207 †
Branner, J. C., O problema das seccas do Norte do Brazil, 611 †
Braun, F., Entwickelung der Spanischen Provinzialgrenzen in römischer Zeit, 732 †
Braun, G., Ueber Bodenbewegungen, 215 †; Ueber die Morphologie von Bornholm, 89 †, 193 §, 341 †
Brazil—
Brésil. Ses Limites actuelles, ses voies de pénétration: O. Lima, 97 †
Brésil, ses richesses naturelles, ses industries, 471 †
Chuvas no nordeste da Brazil: E. L Voss, 611 †
Commissão Geographica e Geologica do Estado de S. Paulo. Exploração do Rio Tieté, etc., 328 §
Diamond Fields of Brazil: H. Pearson, 611 †
Expeditions: Dr. Kissenbarth's, 336, Miss Snethlage's, 335
In Brasilien: W. Vallentin, 212 †
Indianern, Zwei Jahre unter den: T. Koch-Grünberg, 737 †
Petrographische Ergebnisse der brasilianischen Expedition 1901: K Schuster, 347 †
Problema das seccas do Norte do Brazil J. C. Branner, 611 †
Studienreise in das tropische Brasilien D. Sandmann, 97 †
Survey Work on Bolivia-Brazil Boundary: P. H. Fawcett, 163 *
Brennecke, W., Sazgehaltbestimmungen aus dem Südwestlichen Stillen Ozean, 738 †
Bride peak, Karakorum, Duke of Abruzzi's ascent of, 331
Brigham, A. P., Capacity of United States for Population, 470 †; Development of Wheat Culture in North America, 42 *
Britain's Sea-story, B.C. 55—A.D. 1805: E. E. Speight and R. M. Nance, 181 §, 217 †
British Columbia—
Coast names, 1592–1906: J. T. Walbran, 469 †, 590 §
British Empire—
Great and Greater Britain: J. E. Barker, 181 §, 217 †
Growth of Empire: A. W. Jose, 349 †
Scientific Geography, Book VII. British Empire: E. W. Heaton, 75 §
Surveys of British Africa, Ceylon, etc. Annual Report of Colonial Survey Committee, 100 †
Your Share of Empire: C. R. Enock, 475 †
British Isles: *see* United Kingdom
British Mountain Climbs: G. D. Abraham, 181 §

Brives, A., Voyages au Maroc, 734 †
Broadfoot, W., Hedin's 'Trans-Himalaya,' 322 §; Parker's 'Ancient Ceylon,' 583 §; Workman's 'Peaks and Glaciers of Nun Kun,' 485 §
Broderick, H.: *see* Hill, C. A.
Brooks, A. H., and others, Mineral Resources of Alaska, 469 †
Brotherus, V. F., Pflanzenphänologische Beobachtungen in Finland, 1906 .. 732
Brown, A. S. and G. G., Guide to South Africa, 466 †
Brown, R. M., Indian Summer, 736 †
Brown, Sir H., remarks on "Mesopotamia; Past, Present, and Future," 15
Brown, W. C., and C. H. Johnson, New Outlook Geography. Book I. How people live, 75 §
Bruce, W. S., R.G.S., Medal awarded to, 591; Proposed Antarctic expedition, 600
Brückner, A.: *see* Brückner, E.
Brückner, E., Zur Frage der Entwickelung der Rhein-Rhone-Wasserscheide, 462 †; und A. Brückner, Zur Frage der Farbenplastik in der Kartographie, 98 †
Bruel, G. Basses vallées de l'Oubangui et de la Sanga, 609 †
Brun, A., Chahorra (Iles Canaries), 344 †; Verhalten des Schwefels in tätigen Solfataren, 739 †
Brunhes, M. J., Researches on Baer's law of River Erosion, 727
Bseita plain, Arabia, 243
Bué, Liberia, 288
Buenos Aires—
Maps: Plan de la Ciudad de Buenos Aires (Dept. de Obras Publicas), 102 †
Buffault, P., De l'origine prétendue marine des lacs du littoral de Gascogne, 607 †
Bugard, —, Rochefort-sur-Mer, ses rades et son port, 341 †
Bureau, J., explorateur canadien: N. le Vasseur, 474 †
Bürger, O., Acht Lehr- und Wanderjahre in Chile, 439 §, 471 †
Burma—
En Birmanie; souvenirs de Chasse et de Voyage: Prince G. Sturdza, 66 §, 209 †
Burn, J., Survey of Aboinia River, Southern Nigeria, 596
Buru island—
Toehten op het etland Boeroe: J. Van der Miesen, 608 †
Burwash, E. M., Structures in vicinity of Rogers Pass, 96 †
Bushman of Kalahari Desert, R. Poch's studies of, 452
Bushmanland, South-West Africa, Flora of, 488, 491
Bustamente y Guerra, Don J. de: *see* Malaspina, A.
Buxton, E. M. W., By road and river, descriptive geography of British Isles, 76 §, 208 †
Byhan, A., Polarvölker, 472 †

C.

Cables—
Kabelnetz der Erde und der überseeische Nachrichtenverkehr im Jahre 1909: G. Webersik, 349 †
Cadbury, W. A., Labour in Portuguese West Africa, 588 §, 735 †
Cahill, B. J. S., Account of New Land Map of World, 99 †
Cairo—
Kairo-Bagdad-Konstantinopel: E v Hoffmeister, 465 †
Calendar—
Simplified Calendar, Proposal for a: A. Philip, 472 †
California—
Desert Watering Places in South-Eastern California and South-Western Nevada: W. C. Mendenhall, 470 *
Earthquake of April 18, 1906. Report of State Earthquake Investigation Commission: A. C. Lawson, 212 †; Kalifornische Erdbeben vom 18. April, 1906: A. Klautzsch, 611 †
Wheat production, 44
Calkins, F. C., and D. F. MacDonald, Geological Reconnaissance in Northern Idaho and North-Western Montana, 736 †
Calverley woods, quarries in, Vegetation of, 717
Calvinia, South-Western Africa, flora of district round, 488
Cambodia—
Exploration in Cambodia and Annam H. Maitre, 593
Irrigations et la mise en valeur de la vallée du Mékong au Cambodge — Truffot, 93 †
Mission Archéologique au Cambodge E. Lunet de Lajonquière, 343 †
Cambridgeshire—
County Geographies. Cambridgeshire: T. McK. Hughes and M. C. Hughes, 322§, 463 †
Rivers, Cambridgeshire: W. Cunningham, 700 *
Cameron, A. D., Canada's Farthest North, 705; New North, 329 §, 469 †
Campbell, M. R., Contributions to Economic Geology, Part II. Coal and Lignite, 347 †; Kohlenfelder der Vereinigten Staaten (Map), 222 †
Cana, F. R., South Africa from Great Trek to the Union, 211 †, 326 §
Canada—
Arctic Archipelago, Captain Bernier's Expedition in, 81
Canada, Empire of the North. A. C. Laut, 469 †, 590 §
Canada's Fertile Northland: R. E. Young, 610 †
Coalfields of Manitoba, etc.: D. B. Dowling, 610 †
Farthest North, Canada's: A. D. Cameron, 705

Canada—*continued.*
Forests, Waterways, and Water-powers, Evidence of R. E. Young, 469 †
Geology and Economic Minerals of Canada, Descriptive Sketch of: G. A. Young, 610 †
Great Mackenzie Basin: E. J. Chambers, 469 †
Interior, Dept. of, Annual Report for 1908..96 †; Report of Chief Astronomer, 1907..346 †; Topographical Surveys Branch, Annual Report, 1907–08..97 †
Maps—
Manitoba, Saskatchewan and Alberta. Railway Lands Branch, 743 †
Sectional map of Canada (Dept. of Interior), 222 †, 618 †
Standard Topographical map of Canada (Dept. of Interior), 222 †, 618 †, 743 †
Topographic map of Canada (Dept. of Militia and Defence), 222 †
Marine and Fisheries, Supplement to Annual Report of Department of, 96 †
Maritime Provinces of Canada, Geological cycles in: G. F. Matthew, 610 †
New North: A. D. Cameron, 329 §, 469 †
Wheat production, 47
Wood Bison, Explorations in district inhabited by: H. V. Radford, 596
Canals and Waterways, Royal Commission on, Report, 565
Canary islands—
Chaharro (Iles Canaries): A. Brun, 344 †
Exkursion nach den canarischen Inseln: C. Schröter, 344 †
Eruptions in, 60
Vegetation der Canarischen Inseln, Beiträge zur Kenntnis der: H. Schenck, 344 †
Cape Colony—
Cap de Bonne Espérance au XVII^e Siècle: H. Dehérain, 68 §
Flora of, 712
Geology of Parts of Prieska, etc.: A. W. Rogers and A. L. du Toit, 609 †
Carinthia—
Geschichtlicher Rückblick auf die Innerkrainer Höhlen und eine kurze Beschreibung derselben: G. A. Perko, 341 †
Klagenfurter Becken: N. Krebs, 606 †
Carnegie, Launching of, and Departure on First Cruise: L. A. Bauer, 613 †; Magnetic Survey Yacht, and her Work, 216 †
Carney, F., Geographic Influences in Development of Ohio, 737 †
Carpathians—
Balsazar Hacquet als Karpathenforscher: H. Seidel, 606 †
Glazialgeologische Untersuchung der Liptauer Alpen: R. Lucerna, 606 †
Carpathians—*continued.*
Morphometrische Studien über die Ost Karpatischen Gebirgsformen: E. von Romer, 720
Tektonik der Karpathen: V. Uhlig, 606 †
Carruthers, D., Journey in North-Western Arabia, 225 *; R.G.S. Award to, 591; and J. H. Miller, and M. P. Price, Expedition to North-Western Mongolia, 333
Carson, W. E., Mexico; Wonderland of the South, 470 †, 590 §
Cartago Costa Rica, Earthquake at, 724
Carter, O. C. S., Earthquakes in Light of New Seismology, 99 †
Cartographical Instrument, New, designed by E. Ritter von Orel, 338
Cartography—
Farbenplastik in der Kartographie, Zur Frage der: E. und A. Brückner, 98 †
Service Géographique de l'Armée Rapport sur les travaux exécutés en 1908 . . 472 †
Carus, P., and F. V. Holm, Nestorian Monument, 93 †
Carus-Wilson, C., Pitting of Flint surfaces, 215 †
Cash, C. G., Anson's Voyage round World, 1740–1744 . . 192 §, 217 †
Casson, H. N., Cyrus Hall McCormick, his life and work, 217 †
Castellanos, E. M., Breves apuntes sobre Geologia y Climatologia del Istmo de Tehuantepec, 346 †
Catalogue—
Manuscripts in Library of Hunterian Museum in University of Glasgow, Catalogue of: J. Young and P. H. Aitken, 475 †
Catalonia—
Geomorphologische Studien aus Catalonien: A. Rühl, 732 †
Caucasus—
Apsheron Peninsula, Physical Geography of, 195
Cauvet, G., Sables du Sahara Algérien, 96 †
Cazaux—
Origine marine du lac de Cazaux, Preuves géologiques et biologiques de: P. Bergon et F. Lalesque, 341 †
Cecil, Lord W. G., Changing China, 733 †
Celebes—
Maps: Overzichtskaart van het eiland Celebes (Top. Bureau, Batavia), 101 †
Onderzeese vorm van Celebes; J. F. Niermeyer, 608 †
Ceylon—
Ancient Ceylon: H. Parker, 209 †, 583 §
Handbook for travellers in India, Burma, and Ceylon: J. Murray, 210 †
Survey Department, Report of: R. S. Templeton, 98 †

Chad—
Basses pressions dans la région du Tchad, Sur l'existence probable d'un centre très accentué de: J. Tilho, 609 †
Région du Tchâd avec la Mission Tilho, Dans la: L. R. de Melin, 468 †
Chadwick, O.: *see* Middleton, E.
Chaillé-Long, Colonel, Honour to, 727
Chailley, J., Inde britannique, 733 †
Chalk pits or deneholes, 76
Chamberlain, J. F., Report of Committee on Secondary School Geography, 349 †
Chamberlin, T. C., and R. D. Salisbury, Geology: Shorter course, 215 †
Chambers, E. J., Great Mackenzie Basin, 469 †
Chandler, E., Mantle of the East, 733 †
Channer, H., Photographs of Bahr-el-Ghazal, 104 †
Chantre, B., Sur les Routes de Tunisie, 736 †
Chapman, F. H., Camps and Cruises of an Ornithologist, 212 †, 330 §
Charasa, Karakoram, 640
Charcot, J., Antarctic Expedition, 337, 599
Chari monastery, 28
Charts, New—
Admiralty, † 103, 223, 355, 479, 619, 741
Meteorological Charts of Indian Ocean and Red Sea (Met. Office, London), † 103, 223, 355, 479, 619, 744
Meteorological Charts of North Atlantic and Mediterranean (Met. Office, London), † 103, 223, 355, 479, 619, 744
Meteorological Charts of N. and S. Atlantic (U.S. Weather Bureau), † 103, 223, 355, 479, 744
Meteorological Charts of N. and S. Pacific (U.S. Weather Bureau), † 103, 223, 355, 479, 744
Pilot Charts of Indian Ocean (U.S. Hydrog. Office), 223 †, 619 †, 744
Pilot Charts of N. and S. Atlantic (U.S. Hydrog. Office), † 103, 223, 355, 479, 619, 744
Pilot Chart of N. & S. Pacific (U.S. Hydrog. Office), † 103, 223, 355, 479, 619
Chatterton, E. K., Sailing Ships, 192 §
Chavannes, E., Le T'ai Chan, 733 †
Cheadle, W. B., obituary, 727
Cheshire—
Cambridge County Geographies, Cheshire: T. A. Coward, 322 §, 463 †
Chesneau, M.: *see* Gentil, L.
Chevalier, A., Extension et régression de la forêt vierge de l'Afrique tropicale, 468 †; Région des sources du Niger, 610 †; Tourbières de rochers de l'Afrique tropicale, 468 †
Chile—
Acht Lehr- und Wanderjahre in Chile: O. Bürger, 439 §, 471 †
Anexos à la Memoria presentada por el Ministro Dr. C. Pinilla, 97 †
Chile—*continued.*
Censo Jeneral de Poblacion . . . del Territorio de Magallanes: L. N. Avaria, 589 §
Chile en 1906: E. Poirier, 471 †.
Frontéra Argentino-Chilena. Demarcacion General 1894–1906 . . 588 §
Handbook, compiled by International Bureau of American Republics, 69 §, 97 †
Maps: Republica de Chile (Oficina de Mensura de Tierras), 478 †
Primera Memoria del Director de la Oficina de Mensura de Tierras pasada al Señor Ministro de Colonizacion en Abril de 1908 . . 440 §
Time, Standard, adopted by Chile, 199
Volcán Rininahue, Nota sobre la ceniza del: E. H. Ducloux, 612 †
Vulkane Vallarica in Süd-Chile, Ueber den Ausbruch des: R. Lütgens, 612 †
China—
Changing China: Lord W. Gascoyne Cecil, 733 †
China: its Marvel and Mystery: T. H. Liddell, 184 §, 209 †
Chinesische Holland in Mittelchina: P. A. Tschepe, 343 †
Dans les marches tibétaines. Autour du Dokerla (1906–1908). J. Bacot, 464 †, 586 §
English in China: J. B. Eames, 209 †
Face of China: E. G. Kemp, 983 §, 209 †
Maps—
Carte de la Chine Orientale: J. B. L. Friquegnon, 221 †
Routenaufnahme von Min-Tschou bis Long-Kü-Tsai: K. Futterer, 221 †
Nestorian Monument, Ancient record of Christianity in China: F. V. Holm and P. Carus, 93 †
North-West, Explorations by R. Clark, 595
Photographs of Ché-Chiang: H. R. Davies, 223 †
Sira-Muren and Khingan Mountains, a travel to: R. Torii, 93 †
T'ai Chan; essai do monographie d'un culte chinois: E. Chavannes, 733 †
Travels on China-Tibetan frontier: J. Bacot, 595
Wall of China, Great: W. E. Geil, 343 †, 584 §
Chinese Empire—
Chine Occidentale (Thibet, Mongolie): H. d'Ollone, 607 †
Expedition Filchner nach China und Tibet, 1903–1905, Wissenschaftliche Ergebnisse der: W. Filchner, 464 †
Chinese Turkestan: *see* Turkestan
Chiricahua Mountains, Plant Geography of: J. C. Blumer, 611 †
Chisholm, G. G., A hundred years of commerce between England and America, 474 †

Cholnoky, E. von, Eis des Balatonsees, 89 †
Cholnoky, J. v., Kunstliche Berieselung in Inner-Asien und die Völkerwanderung, 343 †
Chong Kumdan glacier, Karakoram, 648
Christiania—
Maps: Kristiania Omegn (Norges Geog. Opmaaling), 477 †
Christie, W. A. K.: *see* Holland, Sir T. H.
Christison, D., River Plate Region forty-three years ago, 213 †
Chrystal, G., Investigation of Seiches of Loch Earn by Scottish Lake Survey, 92 †; Seiches in Lakes of Scotland, 208 †
Chudeau, R. (*see also* Gruvel, A.), Sahara Soudanais, 66 §
Chukchee, The: W. Bogoras, 210 †
Chulung river, Karakoram, 637
Chumik glacier, Karakoram, 627, 634
Chun, C., Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer *Valdivia* 1898–1899 . . 216 †
Church, G. E., obituary, 203; remarks by L. Darwin on death of, 206
Ciria y Vinent, D. J. de, Excursiones en la provincia de Léon, 90 †
Cirque and its Recession, 147
Clairaut, A., Théorie de la figure de la terre, 738 †
Clapp, F. G., and W. S. Bayley, Underground Waters of Southern Maine, 97 †
Clark, R., Explorations in North-West China, 595
Clarke, E. R., Mountaineering on Ski, 100 †
Climatology—
Climate of historic past: E. Huntington, 99 †
Extremen thermischen Anomalien auf der Nordhemisphäre: F. v. Kerner, 472 †
Handbuch der Klimatologie: J. Hann, 472 †
Clouds—
Häufigkeitszahlen der Bewölkung: A. v. Obermayer, 613 †
Studien über die Bewolkung: A. S. Steen, 348 †
Clouzot, E., Problème de la formation des Villes, 474 †
Coast—
Erosion of the Coast and its prevention: F. W. S. Stanton, 472 †, 582 §
Coblenz—
Kulturgeographie des Koblenzer Verkehrsgebietes: R. Martiny, 193 §, 342 †
Cochin China—
Relation du second voyage à la cochinchine du Navire Henri: l'hilipon et Rey, 343 †
Cockayne, L., Report on botanical survey of Stewart island, 612 †
Codrington, T., Some notes on Neighbourhood of Victoria Falls (Rhodesia), 211 †
Coen, G., Seconda colonia italiani: Il Benadir, 610 †
Collet, O. J. A., Île de Java sous la domination française, 465 †, 586 §
Collet, L. W., Helland-Hansen and Nansen's "Norwegian Sea," 172 §; Wolfenden's "Scientific and Biological Researches in North Atlantic," 442 §
Collins, M., remarks on "Geographical Factors that control Development of Australia," 677
Colombia—
Geografia del Departamento de Barranquilla: A. Revollo, 737 †
Mapping of, 81
Maps: Atlas Completo de Geografia Colombiana: F. J. Vergara y Velasco, 102 †
Photographs: H. Bingham, 620 †
Scientific Expedition under O. Fuhrmann, 198
Tratado entre las Repúblicas de Columbia y de Panamá: E. Cortes et C. C. Arosemena, 213 †
Colonial Survey Committee. Surveys of British Africa, Ceylon, etc., 100 †
Colorado—
Geological Survey, First Report, 1908: R. D. George, 611 †
Landslides in San Juan Mountains: E Howe, 736 †
Colorado desert: W. C. Mendenhall, 212 †
Colquhoun, A. R, 1912? Germany and sea-power, 207 †
Colvin, I. D., South Africa (Romance of Empire Series), 68 §
Commerce—
Hundred Years of Commerce between England and America: G. G. Chisholm, 474 †
Comyn, D., letter from, on Barchans or Desert Sand-dunes, 605
Conder, C. R., obituary, 456
Congo, Belgian—
Ethnographie congolaise: C. Delhaise, 344 †
Faune Entomologique du Congo Belge, Catalogues raisonnés de la: H. Schouteden, 94 †
Great Britain and the Congo: E. D. Morel, 188 §, 210 †
Loi sur le gouvernement du Congo Belge: J. Tournay-Detillieux, 327 §, 466 †
Nel Paese dei Bango-Bango: M. Pisciolelli, 733 †
Note sur la vie familiale et juridique de quelques populations du Congo Belge: A. Hutereau, 344 †
Question de l'acclimatation du Congo: Dr. Dryepondt, 466 †
Traversée du Congo Belge: Prince Albert de Belgique, 344 †
Congo, French—
Au pays des Pahouins: Du Gabon au Cameroun: Roche, 94 †

Congo, French—*continued.*
De Brazzaville à Franceville: M. A. Baudon, 94 †
Forêt et Savanes Congolaises: Moll, 345 †
Congo-Zambezi watershed: Naturalist's travels on, S. A. Neave, 182 *
Congresses—
Americanists, Seventeenth Congress of, 602
Geological Congress, Eleventh International, 601
Coningham, Survey work in Sudan, 539
Connecticut—
Underground water resources of Connecticut: H. E. Gregory and E. E. Ellis, 736 †
Continents, True boundaries of, letter from E. Fennell on, 728
Conway, Sir M., remarks on: "The Hispar glacier," 129; "Explorations in Bolivia," 530
Cooch Behar, Maharajah of, Thirty-seven years of big-game shooting in Cooch Behar, Duars and Assam, 184 §, 209 †
Cook, F., North Polar Journey of, 200
Coolidge, W. A. B., Bernese Oberland, 181 §
Coquidé, M., Pêche à la Morue, 473 †
Cora, G., Spedizione del Duca degli Abruzzi ai Monti Karakorum, 93 †
Coral Island Question: F. W. Jones, 472 †
Coreta, F. V. y, Causas de la esterilidad de la Mancha, 732 †
Cornice glacier, Himalayas, 129, 131
Cornish, V., remarks on "Sand-dunes of Libyan desert," 392; Wind-waves in Water, Sand, Snow, and Cloud, 348 †
Cornwall—
Grundzüge der Oberflächengestaltung Cornwalls: H. Spethmann, 91 †
Küste der Englischen Riviera: H. Spethmann, 91 †
Stone Circles of East Cornwall: H. St. G. Gray, 91 †
Coronation gulf, Eskimo of, 297
Corsica—
Nineteen Days in Corsica: T. G. Ouston, 607 †
Cortes, E., et C. C. Arosemena, Tratado entre las Repúblicas de Columbia y de Panamá, 213 †
Cortes, M., Art of Navigation, 218 †
Cortinois, A., ed E. Cucinotta. Vie di communicazione e mezzi di trasporto della Colonia Eritrea, 609 †
Cortier, Lieut., Exploration au Sahara, 735 †
Corumba, Brazil, 517
Cosmas Indicopleustes, Christian Topography of: E. O. Winstedt, 474 †
Costa Rica—
Earthquake in, May, 1910..724
Viajes por la Costa del Pacífico. De San Salvador á Costa Rica: J. M. S. Peña, 213 †
Cottes, A., Guinée Espagnole, 735 †
Cousins, J. H., Modern Geography for Irish Intermediate Schools, 75 §
Contts, J., History of University of Glasgow, 614 †
Covert, C. C., and C. E. Ellsworth, Water-supply Investigations in Yukon-Tanana region, Alaska, 346 †
Coward, T. A., Cheshire. Cambridge County Geographies, 322 §, 463 †
Cox, R. H., Guide to Avebury and Neighbourhood, 321 §
Cox, Sir E. C., My thirty years in India, 184 §, 209 †
Craig, J., Non-Magnetic Gas Engine of *Carnegie*, 613 †
Craig, J. I., Earth-movements at Lake Victoria, 96 †
Crammer, H., Struktur und Bewegung des Gletschereises, 613 †; Zur Frage ineinander geschalteter Taltröge in den Alpen, 340 †
Crean, F. J. P., Report of exploration between Saskatchewan and Churchill rivers, 1909..470 †
Credner, R., Schriftverzeichnis von: H. Runge, 217 †; Zum Gedächtnis Rudolf Credners: O. Jaekel, 217 †
Crete—
Crete, the Forerunner of Greece: C. H. and H. Hawes, 134 §, 462 †
Explorations in Crete: E. H. Hall, 607 †
Crooke, W., Fryer's East India and Persia, 181 §
Crosthwaite, W. H., Survey Work in Lower Nubia, 1908-1909..345 †
Croydon—
Chapter in History of Croydon: B. Latham, 91 †
Crystalline Rocks, Ground-water in: E. E. Ellis, 726
Cuba—
Conférence sur l'Ile de Cuba: C. Berchou, 213 †
Proportion of Sexes produced by Whites and Coloured Peoples in Cuba: W. Heape, 347 †
Cubbeos Indians, Brazil, 690
Cufino, L., L'oasis de Djanet, 735 †
Cunningham, W., Cambridgeshire Rivers, 700 *
Cucinotta, E.: *see* Cortinois, A.
Curaçao, Photographs of: H. Bingham, 620 †
Curzon, Lord, Place of India in Empire, 184 §, 209 †
Cuzco and Sacsahuaman: H. Bingham, 737 †
Cvijić, J., Annexion de la Bosnie et la question Serbe, 88 †
Czapek, F., Zur Kenntnis des Phytoplanktons in Indischen Ozean, 614 †

D.

Dahome—
Rois du Bas-Dahomey: A. Bartet, 346 †
Dainelli, G., In Africa (Lettere dall' Eritrea), 466 †

Dairen, Port of, Trade and Navigation, Report for 1908 (Consular Rep.), 196 §, 606 †
Dakota—
Wheat production, 44
Dalmatia—
Maps: Generalkarte von Dalmatien, Bosnien und Hercegovina: G. Freytag, 615 †, 740 †
Dalton, L. V., On Origin of Petroleum, 789 †; Sketch of Geology of Baku and European Oil-fields, 89 †
Damas, D., Océanographie de la mer du Grönland, 98 †
Danish North-East Greenland Expedition, 1906–8, Provisional Results: J. Lindhard, 541 †
Danmarkshavn, Greenland, Scientific observations at, 551, 552
Dardanelles—
Origin of: R. Hoernes, 448
Dar Nuba, Kordofan, 254
Darton, N. H., Our Pacific North-West, 212 †; and C. E. Siebenthal, Geology and Mineral Resources of Laramie Basin, Wyoming, 97 †
Darwin, C., Darwin's Bedeutung in der Geographie: W. Ule, 217 †
Darwin, L., Death of King Edward VII., 621; remarks on: Award of Special Medal to R. E. Peary, 339; death of Colonel Church, 206; "Explorations in Bolivia," 529, 532; "Geographical Factors that control Development of Australia," 677; "Glacier Exploration in Eastern Karakoram," 653; "Hispar Glacier," 130; International Map Conference, 87; "Journeys in Bhutan," 40, 41; "Journeys in Kurdistan," 378; "Journey in North-Western Arabia," 245, 248; "Mesopotamia: Past, Present, and Future," 15; "Naturalist's Travels on Congo-Zambezi Watershed," 144, 146; "Travels of a Botanist in South-West Africa," 511, 513
Dautremer, J., Empire japonais et sa vie économique, 464 †, 586 §
David, S. W. E., Evidence of Recent Submergence of Coast at Narrabeen, 612 †
Davidson, W., remarks on "Geographical Factors that control Development of Australia," 681
Davies, A. M., Geography of British Isles, 75 §, 91 †
Davies, H. R., Photographs of Chê-Chiang, China, 223 †
Davis, C. A.: *see* Bastin, E. S.
Davis, W. M., Glacial Erosion in North Wales, 208 †
Davison, C., Earthquakes and their Causes, 99 †
Dawe, M. T., Forests of Uganda, 736 †
Deas, J., and F. Mort, Surveying in Schools, 100 †
Debenedetti, S., Excursión arqueológica á las ruinas de Kipón, 97 †
Defant, A., Schneedichtebestimmungen auf dem Hohen Sonnblick, 462 †; Seespiegelschwankungen in Riva am Gardasee, 592 §, 732 †
Dehérain, H., Cap de Bonne-Espérance au XVII^e Siècle, 68 §
Delachaux, E. A. S., Regiones físicas de la República Argentina, 598 §, 611 †
Delafosse, M., Peuple Siena ou Senoufo, 467 †
Delhaise, C., Ethnographie Congolaise, 344 †
Delingetti, G., Carte Général de l'Afrique Équatoriale Française, 616 †
Delos—
Exploration archéologique de Délos: T. Homolle et M. Holleaux, 731 †
Demangeon, M., Dans les Highlands d'Ecosse, 468 †; Voyages en France au XVII^e Siècle, 607 †
Denebolas—
Denebolas and other Chalk Excavations; their Origin and Uses: J. W. Hayes, 76 §, 91 †
Denmark—
Breddebestemmelser udførte i Aarene 1890–92 efter Horrebows Metode: V. H. O. Madsen and M. J. Sand, 89 †
Danske Havne-Lods, 341 †
Maps: Kort udgivet af det Kongelige Danske Søkort-Arkiv, 220 †
Nivellement over bredere Vandarealer: G. K. C. Zacharias, 89 †
Derbyshire—
Geology of . . . South Derbyshire Coalfield: C. Fox-Strangways, 208 †
Desbuissons, L., Vallée de Binn (Valais), 208 †
Descombes, P., Première étape de l'Association Centrale pour l'Aménagement des Montagnes, 341 †
Deserts—
Morphologie der Wüsten: A. Penck, 613 †
Desiccation—
Het uitdrogings-proces der aard-oppervlakte: M. J. H. Böeseken, 472 †
Deuerling, O., Pflanzenbarren der afrikanischen Flüsse, 184 §, 210 †
Deventer, J. de, Atlas des Villes de la Belgique au XVI^e Siècle, 351 †
Devon—
Küste der Englischen Riviera: H. Spethmann, 91 †
Dewavrin, M., Colonisation de l'île d'Anticosti, 610 †
Diaz, Bernal, True History of Conquest of New Spain, vol. 1, Translated: A. P. Maudslay, 68 §, 736 †
Dickinson, F. A., Lake Victoria to Khartum with rifle and camera, 437 §, 468 †
Dickson, B., Journeys in Kurdistan, 357 *
Diemer, W., Besiedelung des Vogelsbergs, 731 †
Diesing, E., Eine Reise in Ukonongo (Deutsch-Ostafrika), 346 †; Von Joko

nach Ngaumdere, Eine Reise in Adamaua, 95 †
Dike, P. H., Report on Atmospheric Electricity Observations made on Magnetic Survey Yacht *Galilee*, 1907–08.. 215 †
Dok-yong-la, Bhutan, 23
Don river, Banffshire, 446
Dordogne—
Découvertes préhistoriques dans la Dordogne: E. Pittard, 607 †
Douglas, Sir A. P., Dominion of New Zealand (All Red Series), 71 §
Douglas glacier, Great, New Zealand, 336
Douglass, A. E., Crescentic Dunes of Peru, 213 †; Weather Cycles in Growth of Big Trees, 335 §, 611 †
Dove, K., und Dr. Frankenhauser, Deutsche Klimatik, 730
Dowling, D. B., Coal-fields of Manitoba, etc., 610 †
Dowson, E. M., Consideration of Magnitude of Nile Flood in 1908..345 †; Measurement of Volumes discharged by Nile during 1905 and 1906..345 †
Draa—
Etude sur l'Oued Draa Supérieur: Hachemi ben Mohammed, 468 †
Drage, G., Austria-Hungary, 179 §
Drift-currents—
Frage von der Ablenkung der Triftströmungen: V. W. Ekman, 216 †
Dryepondt, —, Question de l'acclimatation au Congo, 466 †
Drygalski, E. von, Deutsche Südpolar Expedition 1901–1903..98 †
Dublin—
Maps: Plan of Dublin: J. Bartholomew and Co., 351 †
Dubois, E., Over het onstaan van de vlakten in het duin, 613 †
Dubois, M., et J.-G. Kergomard, Précis de géographie économique, 349 †
Duchesne-Fournet, J., Mission en Ethiopie: H. Froidevaux and others, 436 §
Ducke, A., Explorations dans le nord de l'état de Para, 611 †
Ducloux, E. H., Nota sobre la ceniza del Volcán Rininahue, 612 †
Dug-gye-jong, Bhutan, 20–22
Dugmore, A. R., Camera adventures in African wilds, 734 †
Dunes (*see also* Sand-dunes)—
Over het onstaan van de vlakten in het duin: E. Dubois, 613 †
Dunstan, W. R., Reports on results of Mineral Survey, Northern Nigeria, 95 †, Ditto, Nyasaland Protectorate, 453 §, 735 †; Ditto, Southern Nigeria, 734 †
Duparc, L., and others, Recherches geologiques et pétrographiques sur l'Oural du Nord, 342 †, 462 †
Dupuy, E., Expedition du Duc des Abruzzes dans le Massif de l'Himalaya, 343 †
Durham, M. E., High Albania, 208 †, 322 §
Duro, Señor D. C. F., (Biography): D. M. de Saralegui y Medina, 474 †

E

Eames, J. B., English in China, 209 †
Earn, Loch—
Seiches of Loch Earn, Investigation of: G. Chrystal, 92 †
Earth—
Antlitz der Erde: E. Suess, 215 †
Face of the Earth: E. Suess, Translated by H. B. Sollas, 473 †
Figure de la terre, Théorie de la: A. Clairaut, 738 †
Past History of Earth as inferred from Mode of Formation of Solar System. T. J. J. See, 473 †
Secular Earth-creep: E. H. S. Schwarz, 99 †
Earth-movements—
Bodenbewegungen, Ueber: G. Braun, 215 †
Earth's Axis, Shifting of: S. D. Townley, 472 †
Earthquakes (*see also* Seismology)—
African ideas on subject of Earthquakes: B. Struck, 99 †
Earthquakes and their Causes: C. Davison, 99 †
Earthquakes, their causes and effects: E. O. Hovey, 215 †
East—
Mantle of the East: E. Chandler, 738 †
Scamper through Far East: H. H. Austin, 184 §, 209 †
East India Company, Calendar of court minutes, etc., of, 1640 1643 E. B. Sainsbury, 607 †
East Indies, Dutch—
Eerste Schip-vaert, Gedaen van de Hollanders naer Oost-Indien mit vier Scheepen: C. Houtman, 218 †
Staatkundige indeeling van Nederlandsch-Indie, 343 †
Topographische Inrichting te Batavia G. P. Rouffaer, 343 †
Ebel, D. J. G., Neuen Strassen durch den Kanton Graubündten, 218 †
Economic Atlas: J. G. Bartholomew, Introduction by L. W. Lyde, 714 †
Ecuador—
Maps: Uberricht von Reisen in Ecuador: W. Sievers, 354 †
Nel Darien e nell' Ecuador: E. Festa 213 †, 327 §
Eden, Garden of, 1, 2
Edgar, F., Grammar of Gbari language, 734 †
Edward VII., King, Death of: L. Darwin, 621
Egypt—
Atmospheric Electricity at Helwan Observatory, Discussion of Observations on: H. E. Hurst, 609 †
Evaporation in Egypt and Sudan: B. F. E. Keeling, 345 †, 449 §

Egypt—*continued.*
Guide to Egypt and Sûdân: Macmillan & Co., 466 †, 588 §
Iron Ores in Egypt, Distribution of: W. F. Hume, 609 †
Irrigation, Egyptian: Sir C. S. Moncrieff, 425 *
Irrigation Services in Egypt and Sudan, Reports upon Administration of, 1908..609 †
Life and Times of Akhnaton, Pharaoh of Egypt: A. E. P. Weigall, 734 †
Maps: Map of Egypt (Survey Dept., Cairo), 478 †, 616 †; Topographical Map of Egypt (Survey Dept., Cairo), 353 †, 478 †, 742 †
Mineral Industry of Egypt: A. E. Thomas, 345 †
Survey Dept., Report on Work of, 1908..345 †
Survey work in, 537
Swedish Zoological Expedition to Egypt and White Nile, 1901, Results of: L. A. Jägerskiöld, 734 †
Travels in Upper Egyptian Deserts: A. E. P. Weigall, 68 §
Eisenmenger, G., Sur l'origine glaciaire du Loch Lomond et du Loch Tay en Ecosse, 92 †
Ekman, V. W., Zur Frage von der Ablenkung der Triftströmungen, 216 †
El Birka lake, Kordofan, 254
Ellice islands—
Report on Gilbert and Ellice Islands: A. Mahaffy, 455
Elliot, G. F. Scott: *see* Scott-Elliot, G. F.
Ellis, E. E., Ground-water in crystalline rocks, 726
Ellis, T. S., Lower Severn Valley, 92 †
Ellsworth, C. E.: *see* Covert, C. C.
El Obeid, town and plain round, Kordofan, 252, 260
Emerson, F. V., Manual of physical geography, 475, 716 §
Enderby Land—
Untersuchung des vor Enderby-Land gedredschten Gesteinmateriales: F. Zirkel und R. Reinisch, 214 †
England—
Geology and Palæontology of North of England, 1902–1908, Papers and Records: T. Sheppard, 91 †
England and Wales—
Maps: Geological Surveys, † 101, 220, 476, 615, 740; Ordnance Surveys, † 100, 220, 351, 475, 615, 740
English Literature, Cambridge History of: A. W. Ward and A. R. Waller, 474 †
Enock, C. R., Great Pacific Coast, 191 §, 469 †; Mexico, 188 §; Your Share of Empire, 475 †
Eredia, F., Climatologia dell' Italia, 731 †
Eritrea—
Dancalia italiana del Nord: D. Odorizzi, 345 †
In Africa (Lettere dall' Eritrea): G. Dainelli, 466 †
Eritrea—*continued.*
Vie di comunicazione e mezzi di trasporto della Colonia eritrea: A. Cortinois ed E. Cucinotta, 609 †
Erkes, H., Reisebilder von den Färöern, 89 †
Eskimo—
Danish Expedition to the Central Eskimo, Project of: K. Rasmussen, 295 *
Euphrates—
Delta and course, 1, 3, 9
Europe—
Elementary Geography, vol. 3, Europe: F. D. Herbertson, 74 §
Geologische Alter und die stammgeschichtliche Bedeutung des Homo Heidelbergensis: E. Werth, 607 †
Maps: Geographische Verteilung der Gewitter-Häufigkeit in Kontinental- und Nord-europa: E. Alt, 352 †; School map of Western Europe (Survey Dept., Cairo), 476 †; Uebersichtskarte von Mitteleuropa (K. Preuss. Landesaufnahme), 615 †
Population in Western Europe, Recent growth of: Sir J. A. Baines, 607 †
Systematic Geography of Europe: G. W. Webb, 716 §, 730 †
Waterways of France, etc., Report on: W. H. Lindley, 341 †
Evans, H. A., Cambridge County Geographies. Gloucestershire, 181 §, 208 †
Evans, H. E., General Geography of World, 75 §
Evans, J. W., remarks on "Cambridgeshire Rivers," 704
Evaporation (*see also* Meteorology)—
Lakes and reservoirs, Studies on phenomena of evaporation of water over F. H. Bigelow, 99 †
Exner, F. M., Ueber eigentümliche Temperaturschwankungen von eintägiger Periode im Wolfgangsee, 606 †
Exploration, Problems in, Central Asia E. Huntington, 395 *

F.

Faeroe Islands—
Reisebilder von den Färöern: H. Erkes, 89 †
Fairchild, D., New Exploration of World, 349 †
Fairgrieve, J., Roads to the North, 91 †
Fale, T., Horologiographia; the art of dialling, 218 †
Faris, R. L., Results of Magnetic Observations made by Coast and Geodetic Survey, 347 †
Faustini, A., E. H. Shackleton e la questione antarctica, 471 †
Fauvel, A. A., Unpublished documents on history of Seychelles Islands anterior to 1810, etc., 98 †
Fawcett, P. H., Explorations in Bolivia, 513 *; Photographs of South America,

480 †; Survey Work on Bolivia-Brazil Boundary, 168 *
Fay, C. E., World's Highest Altitudes and First Ascents, 614 †
Feigerl, G. R. C., Contour relief models of country north and south of London, 351 † Contour Relief Model of greater part of Sussex, 740 †
Feio, Rio—
Exploracão do Feio Aguapehy Rios: G. Moura, 328 §
Fennell, E., letter from, on True Boundaries of Continents, 728.
Ferghana—
Babar-nama Description of Ferghana: A. S. Beveridge, 608 †
Ferguson, H. G., Physiography of Philippine Islands, 94 †
Ferrand, G., Origine africaine des Malgaches, 95 †
Festa, E., Nel Darien e nell' Ecuador, 213 †, 327 §
Fèvre, J., et H. Hauser, Régions et Pays de France, 582 §
Fewkes, J. W., Antiquities of Mesa Verde National Park, 346 †
Fez, Journal of our Mission to: Count Gleichen, 467 †, 588 §
Fichtelgebirge—
Landes- und Siedlungskunde des Fichtelgebirges, Beiträge zur: G. Schulze, 332 §, 341 †
Field, M., remarks on "Notes on Determination of Position near the Poles," 306
Fiji—
Montane Flora of Fiji, Contribution to: L. S. Gibbs, 199 §, 213 †
Filchner, W., Expedition to Antarctic, 455, 600; Wissenschaftliche Ergebnisse der Expedition Filchner nach China und Tibet, 1903–1905..464 †
Finck, F. N., Sprachstämme des Erdkreises, 739 †
Finland—
État des glaces et des neiges en Finlande: A. Heinrichs et V. V. Korhonen, 342 †
Gulf of, Hydrographical work in, 180
Maps: Suomen Kruununmetsäin Kartta, 101 †
Pflanzenphänologische Beobachtungen in Finland: V. F. Brotherus, 732 †
Fischer, H., Einiges über das interne Leben der Eingeborenen Liberias, 467 †
Fishbourne, C. E., R.G.S. award to, 592
Fisher, C. A., Geology and Water Resources of Great Falls Region, Montana, 97 †; Geology of Great Falls Coalfield, 97 †
Fisher, F. G., Photographs of South America, 619 †
Fishes—
Pêche à la Morue: M. Coquidé, 473 †
Fitzner, R., Regenverhältnisse Deutsch-Südwestafrikas, 94 †
Fjords—
Fjorde, Fjärde und Förden. E. Werth, 348 †
Fleet mere, river Trent, 574
Fletcher, L., Introduction to Study of Rocks, 99 †
Flett, J. S., Volcanic Eruption in Teneriffe, 59
Flints—
Pitting of Flint surfaces: C. Carus-Wilson, 215 †
Florence, G., Geology of Rio Tieté, 328
Foga wells, Kordofan, 253
Foligno, C., Story of Padua, 732 †
Food from the Waters, Our. W. A. Herdman, 216 †
Forch, C., Druckgradient im Meerwasser in seiner Abhängigkeit von Temperatur- und Salzverteilung, 738 †
Fordham, Sir H. G., Cartography of Province of France, 1570–1757. 89 †
Forestry—
Questions Forestières: M. Sorre, 474 †
Forests of British East Africa, Report on: D. E. Hutchins, 313 §
Formosa—
Cartographique de Formose jusqu a la fin du XVII^ème Siècle, Connaissance et Représentation: Comte P. Teleki, 93 †
Peoples of Formosa: J. H. Arnold, 344 †
Fox, H. W., remarks on "Naturalist's Travels on Congo-Zambezi Watershed," 145
Fox-Strangways, C., Geology of Leicestershire and South Derbyshire Coalfield, 208 †
France—
Besitzverhaltnisse des französischen Eisenbahnnetzes nach der Verstaatlichung der Westbahn-Linien, 741 †
Cartography of Province of France, 1570–1757: Sir H. G. Fordham, 89 †
Geographie préhistorique de la France E.-A. Martel, 607 †
Habitation en Queyras: R. Blanchard, 89 †
Maps—
Carte de France (Service Géo. de l'Armée), † 221, 352, 476
Carte de la France dressé par ordre du Ministre de l'Intérieur, 476 †
Uebersicht der Befestigungen und des Eisenbahnnetzes von Ost-Frankreich: F. Immanuel, 221 †
Ports, grands, de France; leur rôle économique: P. de Rousiers, 462 †
Récherches physico-chimiques sur l'eau de la côte, à Concarneau: R. Legendre, 89 †
Régions et Pays de France: J. Fèvre et H. Hauser, 582 §
Répartition des originaires des Bouches-du-Rhône dans les autres départements: H. Barré, 89 †

France—*continued.*
Sheep and their Products: L. Perruchot, 592 §
Voyages en France au XVII^e siècle: M. Demangeon, 607 †
Waterways of France, Belgium, Germany, and Holland, Report on: W. H. Lindley, 341 †
Winds, Local, in south of France: E. de Martonne, 718
François, G., Notice publiée par le Gouvernement Général à l'occasion de l'Exposition Franco-Britannique de Londres, 466 †
Fraysse, A.: *see* Mialaret, H.
Frécon, P., Navigation du Rhône, etc., 77 §, 89 †
French, Sir S., remarks on "Travels of a Botanist in South-West Africa," 511
Freshfield, D. W., Address at Annual Meeting of Geographical Association, 314; * remarks on "Glacier Exploration in Eastern Karakoram," 656
Freytag, G., Dislokationskarte des k. u. k. österr.-ungar Heeres, 615 †; Generalkarte von Dalmatien, Bosnien und Hercegovina, 615 †, 740 †; Karte des politischen Bezirkes Hietzing-Ungebung, 614 †; Verkehrskarte von Österreich-Ungarn mit den Balkanländern, 350 †; Verkehrsplan der k. k. Reichshaupt- und Residenzstadt Wien, 615 †
Freytag, G., and Berndt, Schulwandkarte des politischen Bezirkes Horn, 350 †
Freytag, G., und H. Gragger, Schi-Routenkarte der Niederösterreichisch-Steirischen Kalkalpen, 350 †
Friedel, E., und R. Mielke, Landeskunde der Provinz Brandenburg, 207 †
Friedlaender, I., Ueber einige japanische Vulkane, 608 †
Friquegnon, J. B. L., Carte de la Chine Orientale, 221 †
Frobenius, L., Vorläufige ethnographische Ergebnisse der Deutschen Innerafrikanischen Forschungsexpedition, 1907–09, 468 †
Froidevaux, H., and others, Jean Duchesne-Fournet, Mission en Ethiopie, 436 §
Fromaget, —, Hydrographie du fleuve Sénégal, 94 †
Frontier Mountain Warfare, some Principles of: W. D. Bird, 192 §
Frost, F. J.: *see* Arnold, C.
Fryer, J., and W. Crooke, New account of East India and Persia, 1672–1681.. 184 §, 343 †
Fuhrmann, O., scientific expedition to Colombia, 198
Fulton, R.—
Hudson-Fulton Celebration of 1909: G. F. Kunz, 611 †
Furlong, C. W., Gateway to Sahara, 187 §, 211 †
Futterer, K., Routenaufnahme von Min-Tschôu bis Long-Kü-Tsai (Map), 221 †

G.

Galante, A., Quelques observations su la déformation de la transcription de noms géographiques du monde musulman, 350 †
Gale, F. H.: *see* Playne, S.
Galilee, Studies in: E. W. G. Masterman 465 †
Gallois, E., Archipel des Baléares, 90 †
Gallois, L., Atlas General de l'Indo-Chine Française, 221 †
Gambia river—
Navigabilité de la Gambie en amont de la frontière anglaise, 610 †
Gambos natives, Angola, 509
Gannett, S. S., and D. H. Baldwin, Results of Spirit Levelling in West Virginia, 737 †
Garcia, L., Guinea Española, 468 †
Garda, Lake—
Seespiegelschwankungen in Riva am Gardasee: A. Defant, 592 §, 732 †
Garde, G., Aperçu géologique sur les régions situées à l'est et au nord-est du Tchad, 94 †; Résultats de l'exploration géologique et minéralogique de l'Egueï, 96 †
Garos, The: A. Playfair, 733 †
Gascony—
Lacs du littoral de Gascogne, Origine prétendue marine des: P. Buffault, 607 †
Gash river, Abyssinia, 428
Gbari language, Grammar of: F. Edgar, 734 †
Geerts, R., Development of Mining Industry in Kansu, 449
Geflani district, Morocco, 196
Geibel, —, Eingeborenen der deutschen Kalahari, 95 †
Geikie, Sir A., Geological map of Scotland, 220 †
Geil, W. E., Great Wall of China, 343 †, 584 §
Gentil, L., Journeys in Western Morocco, 196; Geological Researches in Atlas mountains, 722; Sur la formation du détroit de Gibraltar, 90 †; et M. Chesneau, Atlas Marocain (map), 617 †
Geographic Factors in History, Operation of: E. C. Semple, 217 †
Geographical Association. Annual Meeting. Address by D. W. Freshfield, 314 *
Geographical Atlases in Library of Congress, List of: P. L. Phillips, 430 §
Geographical Education, Progress of, 315
Geographical Literature of the Month—
Africa, 94, 210, 344, 465, 609, 733
America, 96, 212, 346, 469, 6[illegible]
Anthropogeography and Historical Geography, 216, 349, 473, 739
Asia, 92, 209, 343, 464, 607, 733
Australasia and Pacific Islands, 98, 213, 348, 471, 612, 737
Biography, 217, 474

Geographical Literature of the Month—*continued.*
Europe, 88, 207, 340, 462, 606, 730
General, 100, 217, 349, 474, 615, 739
Mathematical Geography, 98, 215, 472, 738
Physical and Biological Geography, 99, 215, 348, 472, 613, 738
Polar Regions, 98, 214, 471, 612, 738
Geographical Society of Neuchâtel, Anniversary Meeting, 602
Geographisches Handbuch: A. Scobel, 218 †
Geography—
College Unit in Physical Geography: C. F. Marbut, 100 †
Economic Geography: E. Robinson, 349 †
Elementary Geography. Vol. 1, A First Physiography: F. D. Herbertson, 74 §
Elementary practical geography for middle forms: F. Mort, 739 †
Elementary Regional Geography. Ireland and Great Britain in Outline: J. B. Reynolds, 739 †
Erdkunde für Schulen: A. Kirchhoff und F. Lampe, 443 §
Géographie economique, Précis de: M. Dubois et J. G. Kergomard, 349 †
Geology in the field; Jubilee volume of Geologists' Association: H. W. Monckton and R. S. Herries, 463 †
Mathematical: Graphische Lösung von Aufgaben aus der astronomische Erdkunde: M. Möller, 98 †
Military Geography, Introduction to: E. S. May, 717 §
Modern Geography for Irish Intermediate Schools: J. H. Cousins, 75 §
New Outlook Geography. Book I. How people live: W. C. Brown and C. H. Johnson, 75 §
Oxford, Progress of Geography at, 315, 316
Oxford School of Geography, Lectures, etc., 601
Physical and Economic geography of World: C. A. Wood, 475 †
Physical geography, Manual of: F. V. Emerson, 475 †, 716 §
Practical Exercises in Geography: B. C. Wallis, 75 §, 100 †; Key to: B. C. Wallis, 739 †
Practical geography for secondary and supplementary schools: J. and W. Miller, 218 †, 716 §
Practical Geography. Part II.: J. F. Unstead, 74 §
School journeys, Typical, series of open-graphy and nature studies: G. G. Lewis, 475 †
Scope of Modern Geography: H. G. Lyons, 614 †
Secondary School Geography, Report of Committee on: J. F. Chamberlain 349 †
Geography—*continued.*
Teaching of geography: L. W. Lyde, 350 †
Teaching of geography in Elementary Schools: R. L. Archer and others, 739 †
Traité de géographie physique, climat hydrographie, etc.: E. de Martonne, 473 †
United States, Present Trend of Geography in: R. H. Whitbeck, 419 *
Geological Congress, Eleventh International, Stockholm, 1910..601
Geological history—
Polynesische alteozäne Festland. H. Höfer, 215 †
Geology—
Geology; shorter course: T. C. Chamberlin and R. D. Salisbury, 215 †
Lehrbuch der Geologie und Mineralogie für höhere Schulen: P. Wagner, 738 †
George, R. D., Colorado Geological Survey. First Report, 1908..611 †
Gerini, G. E, Researches on Ptolemy's geography of Eastern Asia, 733 †
German colonies—
Deutsche Kolonialreich: H. Meyer, 346 †
Einführung der Pflugkultur in die Wirtschaft des Negers in Togo und Deutschostafrika: F. Kolbe, 346 †
Jahrbuch über die deutschen Kolonien: K. Schneider. 218 †
Maps: Grosser deutscher Kolonialatlas: P. Sprigade und M. Moisel, 222 †
Zwanzig Jahre in deutschen Kolonien: W. Langheld, 466 †
Germany—
1912? Germany and sea-power: A. R. Colquhoun, 207 †
Atmosphärischen Isothermen zu der Massenerhebung der mitteldeutschen Gebirgsschwelle: E. Häussler, 731 †
Gliederung des Odenwaldes, Bemerkungen über die: G. Klemm, 730 †
Hydrochemischen Untersuchung des Rheins und Seiner hauptsachlichsten Nebenflüsse: E. Ezger, 731 †
Kainozoischen Vulkane Deutschlands und unsere Vulkantheörien: H. Reck, 342 †
Klimatik, Deutsche: K. Dove und Dr Frankenhauser, 730 †
Maps: Binnenschiffahrtsstrassen im Deutschen Reich: H. Gravelius, 615 †; Karte des Deutschen Reiches (K. Preuss. Landesaufnahme), 101 †, 221; Karte des Deutschen Reiches, (Königl. Sächs. Generalstabes), 741 †
Staubecken im Odergebiete: H. Reisner, 731 †
Wellheimer Trockentals, Zum Problem des: F. Bayberger, 730 †
Ghalia, Wadi el, Kordofan, 256
Gharbia—
Maps: Topographical map of North Gharbia (Survey Dept., Cairo), 742 †

Gharkun, Karakoram, 637
Ghisleri, A., Atlante d'Africa, 616 †
Gibb, A. W., Avon and Don rivers, Banffshire, 446
Gibbs, L. S., Contribution to Montane Flora of Fiji, 199 §, 213 †
Gibraltar, Strait of—
Formation du détroit de Gibraltar: L. Gentil, 90 †
Gibson, C. G., Geological Features of Country along Route of proposed Railway in West Australia, 738 †
Gibson, W., Geology of North Staffordshire coalfields, 208 †
Giglioli, H. H., obituary, 205
Gihon river, Euphrates, 2
Gilbert, G. K., Convexity of Hilltops, 348 †
Gilbert islands—
Report on Gilbert and Ellice islands: A. Mahaffy, 455
Gilgit road, Kashmir, 106
Gill, Sir D., remarks on "Notes on Determination of Position near the Poles," 306
Girty, G. H.: *see* Lee, W. T.
Glacial epoch—
Cause possible de la glaciation du globe terrestre: A. Grégoire, 99 †
Entstehung der Eiszeiten: F. Nölke, 99 †
Neue Erklärung der Entstehung der irdischen Eiszeiten: F. Nölke, 348 †
Glacial erosion—
Inégale répartition de l'érosion glaciaire dans le lit des glaciers alpins: E. de Martonne, 338 §, 613 †
Glacier bay, Greenland, Ice in, 548
Glacier Exploration in Eastern Karakoram: T. G. Longstaff, 622 *
Glacier streams—
Messungen der Schlammführung von Gletscherbächen: E. Gogarten, 348 †
Glaciers—
Alimentation of, 268
Alpine type, 280
Cirques and Bergschrunds, 151, 153
Col and its significance, 161
Configuration of glacier-bed when uncovered, 282
Cycle of Mountain Glaciation: W. H. Hobbs, 146 *, 268 *
Expanded-foot type, 274
Horseshoe type, 280
Ice-cap type, 271
Inherited basin type, 277
Modern Glaciers: W. S. Vaux, 99 †
Nivation type, 270
Observations of Glaciers: H. F. Reid, 99 †
Piedmont type, 271
Relation of glacier to its bed, 270
Struktur und Bewegung des Gletschereises: H. Crammer, 613 †
Tide-water type, 279
Transection type, 274
Types of mountain glaciers, 270, 272
Glaciers—*continued.*
Valley or Dendritic type, 275
Water-erosion within valley during retirement of glacier, 284
Glacier-tables, formation of, 127.
Glasgow—
University of Glasgow, History of: J. Coutts, 614 †
Gleichen, Count, Journal of our Mission to Fez (1909)..467 †, 588 §
Gloucestershire—
Cambridge County Geographies, Gloucestershire: H. A. Evans, 181 §, 208 †
Gnipa cave, Greenland, 550
Godlee Observatory, Fourth Annual Report, 1908..92 †
Godwin-Austen, H. H., R.G.S. Medal awarded to, 591; remarks on "Glacier Exploration in Eastern Karakoram," 659
Gogarten, E., Messungen der Schlammführung von Gletscherbächen, 348 †
Gold, E., and W. A. Harwood, Present State of our knowledge of Upper Atmosphere, etc., 349 †
Gold Coast—
Forests, Report on: H. N. Thompson, 610 †
Gold Coast of To-day: Sir J. Rodger, 467 †
Northern Territories of Gold Coast, Report for 1908 (Col. Reports), 95 †
Plague in Gold Coast in 1908, Report on: W. J. Simpson, 95 †
Golden Trade, Land of: J. Lang, 587 †
Gooszen, A. J., Land en Volk van Zuid Nieuw-Guinea, 213 †
Gosling, W. G., Labrador; its discovery, exploration, and development, 736 †
Gothan, W., Fossilen Hölzer von Kong Karls Land, 215 †
Götzinger, G., Lunzer Seen, 88 †; Studien über das Eis des Lunzer Unter- und Obersees, 606 †
Gouraud, Col., work in Mauritania, 197
Gradmann, R., Kartenskizzen zur Siedlungsgeographie Württembergs, 741 †
Graesse, J. G. T., und F. Benedict, Orbis latinus, oder Vorzeichnis der wichtigsten lateinischen Orts- und Ländernamen, 217 †
Grüf, Dr., Forschungsreise S.M.S. *Planet*, IV. Band, Biologie, 473 †
Gragger, H.: *see* Freytag, G.
Graham's Land—
Klima von Snow-Hill, Grahamland: A. Wosikow, 214 †
Grandidier, A., et G. Grandidier, Ethnographie de Madagascar, 467 †
Grandidier, G.: *see* Grandidier, A.
Grant, S. C. N., remarks on "Notes on Determination of Position near the Poles," 307
Graubündten—
Neue Strassen durch den Kanton Graubündten: D. J. G. Ebel, 218 †
Gravelius, H., Binnenschiffahrtsstrassen im Deutschen Reich (Map), 615 †

Gravity—
Schwerebestimmung an der Erdoberfläche, etc.: O. Hecker, 613 †
Gray, C. J., Report on Mining Industry of Natal for 1907 and 1908..467 †
Gray, F. J., Polar Planimeter; how it is used and how it operates, 215 †
Gray, H. St. G., On Stone Circles of East Cornwall, 91 †
Graz, Climate of, 447
Great Britain—
Great and Greater Britain: J. E. Barker, 181 §, 217 †
Great circles—
Angenäherte Darstellung des Hauptbogens in der Merkatorkarte: Oberstleut. v. Kobbe, 98 †
Greece—
Voyage de Télémaque: A. Merchier, 731 †
Greely, A. W., Handbook of Alaska, 69 §, 96 †; Economic Evolution of Alaska, 96 †; Handbook of Polar Discoveries, 738 †
Greenland—
Birds and animals of East Greenland, 555
Carlsbergfondets Expedition til Ost-Gronland 1898–1900: G. Amdrup, 98 †
Coastal current, 177
Danish North-East Greenland Expedition, 1606–8. Provisional Results: J. Lindhard, 541 *
Eskimo in Greenland, Migration of, 295
Eskimo Settlements in East Greenland, 553, 554
Ethnological description of Amdrup collection from East Greenland, etc.: W. Thalbitzer, 98 †
Geologiske og antikvariske lagttagelser i Julianehaab Distrikt: K. J. V. Steenstrup, 612 †
Insect fauna of East Greenland, 556
Océanographie de la mer du Grönland: D. Damas, 98 †
Grégoire, A., Sur une cause possible de la glaciation du globe terrestre, 99 †
Gregory, H. E., Underground water resources of Connecticut, 736 †
Gregory, J. W., Geographical Factors that control Development of Australia, 658 *
Grenfell, W. T., and others, Labrador; country and people, 470 †
Grieben's Guide Books. Lakes of Northern Italy and Milan, 182 §, 207 †
Griggs, R. F., Divided Lakes in Western Minnesota, 81 §, 347 †
Gröber, P., Explorations in Tian Shan and Dzungaria, 721
Groll, M., Verteilung der Bevölkerung in der Provinz Schlesien, 731 †
Grossmann, L., Ergebnis der Versuche mit dem Bezuge von Wetter-Funkentelegrammen vom Nordatlantischen Ozean, 613 †
Grosvenor, G. H., Scenes from every land, 475 †
Ground-water in Crystalline Rocks: E. E. Ellis, 726
Grubert, A., Siedelungen am Maindreieck, 341 †
Grumbkow, I. von, Isafold: Reisebilder aus Island, 321 §, 462 †
Gruner, G. S., Eisgebirge des Schweizerlandes, 218 †
Gruvel, A., et R. Chudeau, A travers la Mauritanie occidentale, 467 †
Guardafui, Cape, Promontory of. G. Baldacci, 467 †
Guatemala—
Earthquake and Eruption of 1902. W S. Ascoli, 213 †
Guayabero or Guaviare river, 684
Guebhard, P., Peulh du Fouta Dialon, 345 †
Guiana, British—
Handbook for 1909: G. D. Bayley, 346 †
Guinea, French—
Carte démographique de la Guinée: E. Salesses, 452 §, 609 †
Exploration en Haute-Guinée: L. F. Vials, 609 †
Peulh du Fouta Dialon: P. Guebhard, 345 †
Population, Distribution of: E. Salesses, 452
Guinea, Spanish—
Guinea Española: L. Garcia, 468 †
Guinee Espagnole: A. Cottes, 735 †
Guma country, Liberia, 285
Günther, S., Erdbrände und deren angebliche geophysische Konsequenzen, 99 †
Gürich, G., Marmorvorkommen in Deutsch Südwestafrika (map), 617 †
Gwinnel, R. F., Contour Relief-model of Loch Lomond district, 711 †

H.

Haack, H., Petermann-Denkmal in Gotha 474 †
Hachemi ben Mohammed, Etude sur l'Oued Draa supérieur, 468 †
Hacquet, B., Balsazar Hacquet als Karpathenforscher: H Siedel, 606 †; Riesen in der Hohen Tatra H. Siedel, 606 †
Haddon, A. C., Races of Man and their Distribution, 192 §, 217 †
Hah valley and monastery, Bhutan, 20
Haigatum glacier, Hispar glacier, 116, 117
Hakkiari district, Kurdistan, 359
Halász, G. v., Job v. Kompolthy auf dem Jang-tse-Kiang, 607 †
Halbfass, W., Seentorsee im Ostholstein, 731 †; Temperaturmessungen in tiefen Seen in ihrer Beziehung zur Klimatologie, 348 †
Hale, A., Adventures of John Smith in Malaya, 1600–1605..66 §
Halfa to Khartum, Railway from, 333

Hall, E. H., Explorations in Crete, 607 †
Halmahera—
Oostkust van noord-Halmahera: G. J. J. de Jongh, 344 †
Hamar tribe, Kordofan, 259
Hamawand Kurds, 376
Haun, J., Handbuch der Klimatologie, 472 †; Tägliche Variation der Windstärke auf den Berggipfeln in Südindien, etc., 698 †
Harakol Dagh, Kurdistan, 359
Hargrave, L., Lope de Vega, 471 †
Harker, A., Natural History of Igneous Rocks, 192 §
Harper, L. F., Notes on Physiography . . . of Watershed of Macquarie River, 218 †
Harris, L., With Mulai Hafid at Fez, 187 §, 211 †
Harris, R. A., Tides, their causes and representation, 99 †
Harrison, A. H., Plea for British Arctic Expedition, 214 †
Harshberger, J. W., Vegetation of Salt Marshes . . of New Jersey, 453 §, 736 †
Harwood, W. A.: *see* Gold, E.
Hashiramoto, —, Expedition to Chinese Turkestan and Mongolia, 448
Hassinger, H., Expansion of Vienna, 719
Hattori, H., Pflanzengeographische Studien über die Bonin-Inseln, 93 †
Hauptmann, L., und F. Heritsch, Eiszeitliche Vergletscherung der Bosensteingruppe in den Niedern Tauern, 340 †
Hauser, H.: *see* Fèvre, J.
Häussler, E., Beziehungen der atmosphärischen Isothermen zu der Massenerhebung der mitteldeutschen Gebirgsschwelle, 731 †
Haute-Garonne—
Hydrologie souterraine du massif de Penè-Blanque ou Arbas: E.-A. Martel, 607 †
Hautes-Alpes—
Population du département des Hautes-Alpes au XIX^e^ siècle, mouvement de la: P. Moisson, 607 †
Hawes, C. H. and H. B. Hawes, Crete, Forerunner of Greece, 434 §, 462 †
Hawes, H. B.: *see* Hawes, C. H.
Haydon, A., remarks on "Naturalist's Travels in Congo-Zambezi Watershed," 146
Hayes, C. W., and W. Lindgren, Contributions to Economic Geology. Metals and Non-Metals, except Fuels, 347 †
Hayes, J. W., Deneholes and other Chalk Excavations: their Origin and Uses, 76 §, 91 †
Hayford, J. F., Figure of Earth and Isostasy from Measurement in United States, 347 †
Hayti—
En Haïti: E. Aubin, 737 †
Hazard, D. L., Results of Observations made at Coast and Geodetic Survey Magnetic Observatories, 97 †, 736 †
Health—
Influence of Soil and Ground-water upon Health: B. Latham, 474 †
Heape, W., Proportion of Sexes produced by Whites and Coloured Peoples in Cuba, 347 †
Heath river, Bolivia, 166, 521
Heaton, G. W., Scientific Geography. Book vi., Asia, 76 §; Scientific Geography. Book vii., British Empire, 75 §
Hecker, O., Schwerebestimmung an der Erdoberfläche, etc., 613 †
Hedin, S., Trans-Himalaya: Discoveries and Adventures in Tibet, 322 §, 464 †
Heim, A., Ueber die Beatus-Höhlen am Thunersee, 342 †
Heinrichs, A., et V. V. Korhonen, État des glaces et des neiges en Finlande, 342 †
Hejaz railway—
Chemin de fer du Hedjaz: C. E. Bonin, 608 †
Hell, J., Kultur der Araber, 473 †
Helland-Hansen, B., Austernbassins in Norwegen, 732 †; and F. Nansen, Norwegian Sea. Review by L. W. Collet, 172
Hellespont, Straits of, Origin of: R. Hoernes, 448
Hellmund, H. W. B., Drumlinlandschaft zwischen Pfäffiker- und Greifensee (Kanton-Zürich), 343 †
Helmert, F. R., Trigonometrische Höhenmessung und Refraktions-Koeffizienten in der Nähe des Meeresspiegels, 215 †
Helwan observatory—
Discussion of observations on atmospheric electricity at Helwan observatory: H. E. Hurst, 609 †
Hemel, C. v., und J. Reiber, Toricelli-Gebirge (Kaiser Wilhelm-Land) (Map), 354 †
Henkriesfontein Namaqualand, 495
Herbert, A., Isle of Man, 181 §
Herbertson, A. J., Professorship of Geography at Oxford, 316
Herbertson, F. D., Elementary Geography. Vol. 1, A First Physiography, 74 §; vol. 2, In and about our own islands, 74 §, 208 †; vol. 3, Europe, 74 §; vol. 4, Asia, 209 †, 716 §; vol. 7, British Isles, 468 †, 716 §
Herdman, W. A., Our food from the waters, 216 †
Heriki valley, Kurdistan, 372
Heri Rud river, Afghanistan, 397
Heritsch, F.: *see* Hauptmann, L.
Herki Oramar district, Kurdistan, 359
Herries, R. S.: *see* Monckton, H. W.
Hertfordshire—
Cambridge County Geographies. Hertfordshire: R. Lydekker, 91 †
Hertslet, Sir E., and others, Map of Africa by Treaty, 325 §, 465 †
Herzegovina (*see also* Bosnia)—
Bosnia and Herzegovina, some wayside wanderings: M. M. Holbach, 182 §, 207 †

Herzog, T., Reiseweg in Ost-Bolivien (map), 618 †
Hessen—
Besiedelung des Vogelsbergs: W. Diemer, 731 †
Hewby, W. P., Finding of Overweg's Grave at Bornu, 450
Hickmann, A. L., Geographisch-Statistischer Taschen-Atlas von Österreich-Ungarn, 350 †; Geographisch-Statistischen Universal-Taschen-Atlas, 354 †
Hiddekel river, Euphrates, 2
Higbama, E. E., Across a continent in a man-of-war, 213 †
Hildebrandsson, H. H., Quelques recherches sur les centres d'action de l'atmosphère, 613 †
Hill, C. A., H. Brodrick and A. Rule, Mitchelstown caves, co. Tipperary, 209 †
Hill, H., Great Wairarapa, a Lost River, 599 §, 737 †
Hilltops, Convexity of: G. K. Gilbert, 348 †
Himalaya—
Expedition, Duke of the Abruzzi, 330; T. G. Longstaff's, 64
Expedition du Duc des Abruzzes dans le Massif de l'Himalaya: E. Dupuy, 343 †
Hispar Glacier, I. Its Tributaries and Mountains: F. B. Workman; II. Prominent Features of its Structure: W. H. Workman, 105 *, 115 *
Nieve Penitente in Himalaya, Study of. W. H. Workman, 607 †
Nieves penitentes formation, 125, 130, 631
Peaks and Glaciers of Nun Kun: F. B. and W. H. Workman, 210 †, 435 §
Spedizione del Duca degli Abruzzi ai Monti Karakorum: G. Cora, 93 †; Trans-Himalaya mountains, Tibet, 324
Hinks, A. R., Notes on Determination of Position near the Poles, 299 *
Hise, C. R. Van, and C. K. Leith, Pre-Cambrian Geology of North America, 346 †
Hispar Glacier, I. Its Tributaries and Glaciers: F. B. Workman, 105 *; II. Prominent Features of its structure: W. H. Workman, 115 *
Hit, Mesopotamia, 13, 14
Hjort, J., Rapport sur les Travaux de la Commission A dans la période 1902–1907..216 †; Report on Norwegian fishery and marine investigations, 179 §, 216 †
Hobbs, W. H., Cycle of Mountain Glaciation, 146 *, 268 *; Messina Earthquake, 90 †
Hodson, A. W., Notes on Journeys taken in Kalahari Desert, 166 *; Trek in Unknown Country north of Makalakari, 609 †
Hoernes, R., Origin of Straits of Hellespont and Bosporus, 448
Höfer, H., Polynesische alteoxäne Festland, 215 †
Hoffer, M., Unterirdisch entwässerte Gebiete in den nordlichen Kalkalpen, 88 †
Hoffmann, I., Anschauungen der Kirchenväter über Meteorologie, 340 †
Hoffmeister, E. v., Kairo-Bagdad-Konstantinopel, 465 †
Hogarth, D. G., Accidents of an antiquary's life, 739 †; remarks on: "Journey in North-Western Arabia," 245; "Sand-dunes of Libyan Desert," 393
Holbach, M. M., Bosnia and Herzegovina, 182 §, 207 †
Holdich, Sir T., Gates of India, 708 §, 733 †; remarks on: "Explorations in Brazil," 532; "Notes on Determination of Position near the Poles," 308
Holland—
Maps: Chromo-topographische Kaart van het Koninkrijk der Nederlanden, 476 †
Vorming van den Dollart en de terpen in Nederland: J. C. Ramaer, 731 †
Holland, Sir T. H., and W. A. K. Christie, Origin of Salt Deposits of Rajputana, 344 †
Holm, F. V.: *see* Carus, P.
Holmsen, G., Lidt om Spitsbergens geologi, 613 †
Holstein—
Selentersee im Ostholstein. W. Halbfass, 731 †
Homolle, T., et M. Holleaux, Exploration archéologique de Délos, 731 †
Homr, Bahr el, Kordofan, 257
Hone, P. F., Southern Rhodesia, 188 § 211 †
Horologiographia, the Art of Dialling: T. Fale, 218 †
Horwood, C. B., Old Granites of Transvaal and of South and Central Africa, 466 †
Hosseus, C. C., Vegetationsbilder aus Siam, 608 †
Houtman, C., Eerste Schip-vaert, Gedaen van de Hollanders naer Oost-Indien met vier Scheepen, 218 †
Hovey, E. O., Earthquakes, their causes and effects, 215 †
Howazama tribe, Kordofan, 260
Howchin, W., Geological Observations on some of Localities visited by "Governor Musgrave" Party in Jan. 1907..98 †
Howe, E., Landslides in San Juan mountains, Colorado, 736 †
Huascaran, Mount, Altitude of, letter from F. B. Workman on, 458; Height of, 199
Hudson, H.—
Hudson-Fulton Celebration of 1909: G. F. Kunz, 611 †
Hudson bay—
Account of Six Years' Residence in Hudson's Bay: J. Robson, 219 †
Hudson river—
Picturesque Hudson: C. Johnson, 212 † 330 §

Hughes, T. McK., and M. C. Hughes, Cambridgeshire. Cambridge County Geographies, 322 §, 463 †
Huj well, Arabia, 242
Hulwan Khumfi, Arabia, 242
Human Migrations, History of: G. F. Scott-Elliot, 85
Humbe, Fort, Angola, 510
Hume, W. F., Distribution of Iron Ores in Egypt, 609 †
Humpata, Angola, 507
Humphreys, W. J., Vertical temperature gradients of Atmosphere, 614 †
Humphries, T., New Zealand. Report on survey operations for 1908–9 .. 737 †
Hungary—
  Maps: Ethnographical map of Hungary: B. Zsigmond, 476 †; Staatsrechtliche Karte des Ungarischen Reiches: H. Ressö, 476 †
  Ungarns Westliche Grenze im Jahre, 1254: Z. Szakáll, 342 †
Hunterian Museum in University of Glasgow, Catalogue of Manuscripts in Library of: J. Young and P. H. Aitken, 715 §
Huntington, E., Afghan Borderland, 464 †; Climate of historic past, 99 †; Life in Great Desert of Central Asia, 210 †; Problems in Exploration, Central Asia, 395 *
Hunza and Chinese Turkestan, Photographs of: A. R. B. Shuttleworth, 224 †
Hurst, H. E., Discussion of Observations on Atmospheric Electricity at Helwan Observatory, 609 †
Husseinat and Hassania tribes, Kordofan, 259
Hutchins, D. E., Report on Forests of British East Africa, 210 †, 313 §
Hutereau, A., Notes sur la vie familiale et juridique de quelques populations du Congo Belge, 344 †
Hyūga Railway, Depression of land along line of: J. Sasamoto, 94 †

I.

Ibrahimia, Terrestrial Refraction at, 79
Ice—
  Arctic seas, state of ice in 1909 .. 725
  Shelf-ice of Antarctic: E. Philippi, 725
Ice-cap glaciers, 271
Iceland—
  Aufbau der Insel Island: H. Spethmann, 342 †
  Expedition, W. von Knebel's, Disaster to, 78
  Isafold; Reisebilder aus Island: I. van Grümbkow, 321 §, 462 †
  Knebelschen Islandexpedition, 1907, Ergebnisse der: H. Spethmann, 731 †
  Südisländische Gletscher, Bemerkungen über einige: K. Sapper, 342 †
  Vulkanismus am Mückensee auf Island, Beiträge zur Kenntnis des: H. Spethmann, 342 †
Iceland—*continued.*
  Wüstenritte und Vulkanbesteigungen auf Island: C. Küchler, 321 §
Ickis, H. M., Geological Reconnaissance from Infanta, Tayabas, to Tanay, Rizal, 608 †
Idaho—
  Geological reconnaissance in Northern Idaho and North-Western Montana: F. C. Calkins and D. F. McDonald, 736 †
Igneous Rocks, Natural History of: A Harker, 192 §
Illinois—
  Chemical and Biological Survey of waters of Illinois, 212 †
  Wheat production, 44
Immanuel, F., Uebersicht der Befestigungen und des Eisenbahnnetzes von Ost-Frankreich (map), 221 †
India—
  Castes and tribes of Southern India: E. Thurston and K. Rangachari, 733 †
  Cooch Behar, Duars and Assam, Thirty-seven years of big-game shooting in: Maharajah of Cooch Behar, 184 §, 209 †
  Dürren in Britisch-Indien: H. J. Wehrli, 607 †
  East India Company, Calendar of court minutes, etc., of, 1640–1643: E. B. Sainsbury, 607 †
  East India and Persia, New account of, 1672–1681: J. Fryer and W. Crooke, 184 §, 343 †
  Gates of India: Sir T. Holdich, 708 §, 733 †
  Geografía y descripción universal de las Indias: J. L. de Velasco, 219 †
  German Staff Officer in India: Count H. von Königsmarck, 184 §, 464 †
  Handbook for travellers in India, Burma and Ceylon: J. Murray, 210 †
  Inde britannique: J. Chailley, 733 †
  Maps: Government Surveys, 101 †, 221 †, 741 †; Railway map of India: W. & A. K. Johnston, 741 †; Taylor's A.B.C. Railway map of India, 741 †
  Mission archeologique ... dans l'Inde. E. Lunet de Lajonquière, 343 †
  My Thirty Years in India: Sir E. C. Cox, 184 §, 209 †
  Overland Trek from India: E. F. Benn, 183 §, 210 †
  Place of India in Empire: Lord Curzon, 184 §, 209 †
  Reisen in Indien und Hochasien: H. von Schlagintweit, 219 †
  Survey of India, General Report on Operations of, 1907–08 .. 93 †
  Tägliche Variation der Windstärke auf den Berggipfeln in Südindien, etc.: J. Hann, 608 †
Indian ocean—
  Maps: Meteorological Charts of Indian Ocean and Red Sea (Met. Office, London), † 103, 223, 355, 479, 619, 744

Indian ocean—*continued.*
Pilot Chart of Indian Ocean (U.S. Hydrog. Office), 223 †, 619 †, 744 †
Phytoplanktons in Indischen Ozean, Zur Kenntnis der: F. Czapek, 614 †
Temperatur und Salzgehalts der Meeresoberfläche zwischen Suez und Sydney: E. Schwendig, 473 †
Indian Summer: R. M. Brown, 736 †
Indiana—
Wheat production, 44
Indo-China—
Maps: Atlas General de l'Indo-Chine Française: L. Gallois, 221 †
Mission archéologique au Cambodge, etc., Rapport: E. Lunet de Lajonquière, 348 †
Moï du sud Indo-Chinois: H. Maitre, 66 §
Indus, Great floods of, 648
Inkey, B. de, Volcans du Méxique, 346 †
Inn valley—
Entstehung der Innthal-Terrassen: O. Ampferer, 340 †
Innes, R. T. A., Meteorology in Transvaal, 468 †; Transvaal Sea-level Temperatures, 468 †
Iowa—
Wheat production, 44
Ippen, T. A., Skutari und die nordalbanische Küstenebene, 343 †
Ireland—
Black Pig's dyke; ancient boundary fortification of Uladh: W. F. de V. Kane, 91 †
Lichens in Ireland, Distribution of: J. Adams, 463 †
Isachsen, G., Spitsbergenekspeditionen 1907..98 †
Isna dam, Nile, 426
Istria—
Tropfstein- und Wasserhöhle "Dimnice" bei Markovsina in Istrien: G. A. Perko, 88 †
Italy—
Climatologia dell' Italia: F. Eredia, 731 †
Evolution tectonique de la péninsule italienne, etc., C. van de Wiele, 90 †
Geografia fisica in Italia nel Cinquecento: R. Almagia, 732 †
Hydrological research in Italy, 78
Italy to-day: B. King and T. Okey, 182 §, 207 †
Lakes of Northern Italy and Milan. Grieben's Guide Books, 182 §, 207 †
Maps: Befestigungen der österreichisch-italianischen Grenze (map), 352 †.
Nomi storici di alcune vallate dell' Abruzzo, etc.: R. Almagia, 732 †
Regions Sismiques, Italie et ses: M. J. Repelin, 342 †
Ufficio Idrografico: R. Magistrato alle Acque, 90 †
Itbaik, Jebel, Arabia, 236
Itilla river, Amazonia, 688
Itineraru(m) Germaniæ provinciæ continens, 219 †
Ivchenko, A., Schluchten auf dem Plateau Ischokusu, 210 †
Ivory Coast—
Maps: Carte de la Côte d'Ivoire: A. Meunier, 353 †
Iwasaki, J., Recent State of Eruption of Aso Volcano, 93 †

J.

Jack, E. M., Measurement of Semliki Base, 345 †
Jacobites of Kurdistan, 378
Jaeger, F., Forschungen in den Hochregionen des Kilimandscharo, 346 †
Jaekel, O., Zum Gedächtnis Rudolf Credners, 217 †
Jägerskiöld, L. A., Results of Swedish Zoological Expedition to Egypt and White Nile, 1901..734
Jamaica—
Mineral wealth of . . . Jamaica: A. E. Outerbridge, 611 †
James, E. E. C., Bologna: its history, antiquities, and art, 462 †
James, T., Strange and Dangerous Voyage of, in his intended discovery of the North-West Passage, 218 †
Janet—
Oasis de Djanet: L. Cufino, 735 †
Janke, A., Bagdadbahn und der Gülek Boghas im Taurus, 94 †
Janne, Liberia, 286
Japan—
Ancient Tales and Folklore: R. G. Smith, 66 §
Dairen, Port of, Report for 1908 on Trade and Navigation (Consular Rep.), 196 §, 608 †
Depression of land along line of Railway Hyūga: J. Sasamoto, 94 †
Empire Japonais: J. Dautremer, 464 †, 586 §
Vulkane, Ueber einige japanische: I. Friedlaender, 608 †
Jardim, F., Portuguese inscription in Ruins at Ormuz, 449
Java—
Ile de Java sous la domination française: O. J. A. Collet, 465 †, 586 §
Maps—
Spoor en Tramwegkaart van Java en Madoera (Top. Bureau Batavia), 222 †
Topographische Kaart der Residentie Cheribon (Top. Bureau, Batavia), 616 †
Topographische Kaart van Java en Madoera (Top. Bureau, Batavia), 352 †
Jean, C., Touarag du Sud-Est; L'Aïr, 186 §
Jefferson, M., Anthropogeography of some Great Cities, 349 †
Jelu Dagh, Kurdistan, 371

Jensen, H. I., Some Geological Notes on country behind Jervis bay, 612 †
Jerrold, W., Highways and Byways in Middlesex, 181 §, 208 †
Jerusalem—
Devotissimo viaggio di Gerusalemme: G. Zuallardo, 219 †
Jervis bay, Some geological notes on country behind: H. J. Jensen, 612 †
Jesi, Arabia, 227
Jilolo: *see* Halmahera
Johnson, C., Picturesque Hudson, 212 †, 330 §
Johnson, C. H.: *see* Brown, W. C.
Johnson, E. R., Characteristics of American Railway Traffic, 737 †
Johnson, J. P., Ore Deposits of South Africa, 188 §, 211 †
Johnson, W. D., on Glacial Erosion, 151, 155
Johnston, A. K. (*see also* Johnston, W.), Handy Royal Atlas of Modern Geography, 618 †
Johnston, Sir H. H., Berger's 'In Afrikas Wildkammern als Forscher und Jäger,' 586 §; 'Stanley's Autobiography,' 72 §
Johnston, W. & A. K., Basin of Thames (map), 351 †; Railway Map of India, 741 †; World-Wide Atlas of Modern Geography, 354 †
Johnston-Lavis, H. J. (*see also* Bourdariat, A.), Mechanism of Volcanic Action, 473 †
Joly, J., Radioactivity and Geology, 192 §
Jones, F. W., Coral Island Question, 472 †
Jongh, G. J. J. de, Oostkust van Noord-Halmahera, 344 †
Jose, A. W., Growth of Empire, 349 †
Judi Dagh, Kurdistan, 358, 367
Juliana peak, New Guinea, 346
Jurupary river, Amazonia, 688
Jutmaru glacier, Himalayas, 110, 111

K.

K$_2$ Peak, Duke of Abruzzi's expedition to, 330, 728
Kababish tribe, Kordofan, 258
Kabylia—
Eindrücke aus dem Kernlande der Kabylen Algeriens: F. Mielert, 466 †
Kailás mountain, Tibet, 323
Kalahari—
Eingeborenen der deutschen Kalahari: Lieut. Geibel, 95 †
Journeys taken in Kalahari desert, Notes on: A. W. Hodson, 166 *
Travels in Kalahari and studies of Bushman life: R. Pöch, 452
Kambui range, Liberia, 285
Kamerun—
Alkasom-Muntschi-Bascho-Expedition, 95 †
Fauna und Flora der Grashochländer-Kameruns: A. Schultze, 467 †
Forstwissenschaftliche Expedition, 1908–09: — Schorkopf, 95 †
Kamerun—*continued.*
Nigeria-Kamerun Boundary: Captain von Stephani, 197
Vulkanische Ausbruch des Kamerunbergs, 467 †
Kandil range, Kurdistan, 377
Kane, W. F. de v., Black Pig's dyke: ancient boundary, fortification of Uladh, 91 †
Kanibasar glacier, Himalayas, 110, 111, 129
Kansas—
Floods at Kansas City, 58
Wheat production, 48
Kansu—
Mining Industry in Kansu, Development of: R. Geerts, 449
Kara Dagh, Asia Minor, 583
Karakoram mountains—
Expedition of Duke of Abruzzi, 330
Floods in, 648
Glacier Exploration in Eastern Karakoram: T. G. Longstaff, 622 *
Karoo region, South-West Africa, 482, 487
Karst—
Geographischen Zyklus im Karst, Beitrag zum: L. Ritter von Sawicki, 342 †
Ground-water or Subterranean Rivers in Karst region: E.-A. Martel, 601
Karst und Karsthydrographie: D. F. Katzer, 207 †
Karu-chhu or Lobrak-chhu, Bhutan, 32
Karun river, Mesopotamia, 3
Kashmir—
Gondwanas and Related Marine Sedimentary Systems of Kashmir: C. S. Middlemiss, 93 †
Photographs, Reproductions from, taken on Bullock-Workman Expedition of 1906 to Nun Kun, Kashmir, 356 †
Katanga, Mineral area of, 141
Katzer, D. F., Karst und Karsthydrographie, 207 †
Kawaguchi, Shramana Ekai, Three Years in Tibet, 324 §
Kawkaski, F., Befestigungen in Russisch-Polen (map), 352 †
Keane, A. H., and Sir C. R. Markham, Stanford's Compendium of Geography and Travel. Central and South America, 69 §
Keeling, B. F. E., Evaporation in Egypt and Sudan, 345 †, 449 §; Refraction across Nile valley, 99 †
Kestmanshoop, German South-West Africa, 499
Keidel, H., Ueber den Bau der Argentinischen Anden, 97 †
Keltie, J. S., Travellers' Tales, 475 †
Kemp, E. G., Face of China, 183 §, 209 †
Kendall, P. F., remarks on "Some Recent Changes in Course of the Trent," 578
Kenia, Mount—
Photographs of: W. McG. Ross, 224 †
Kensington, W. C., Forestry in New Zealand, 612 †; Reports on scenery preservation, 612 †

Kent—
Water-supply of Kent: W. Whitaker, 208 †
Kerguelen—
Gesteine von der Bouvet-Insel, von Kerguelen, etc.: R. Reinisch, 348 †
Pflanzengeographie der Subantarktischen Inseln, Vergleichende, Darstellung der: H. Schenck, 348 †
Kerner, F. v., Extremen thermischen Anomalien auf der Nordhemisphäre, 472 †
Kharga oasis—
Maps: Topographical Map (Survey Dept., Cairo), 742 †
Movement of Wind and Sand, Observations for, 385
Khatanga—
Expédition de Khatanga de la Société Russe de géographie: I. P. Tolmatschof, 94 †
Khor Abdalla, Mesopotamia, 3
Khumara Su, Kurdistan, 372
Kichik Aktash glacier, Karakoram, 647, 650
Kichik Kumdan glacier, Karakoram, 648
Kiepert, H., Formæ Orbis Antiqui, 354 †
Kiesewetter, J., Karte der Meer- und Hafenfernen von Osterreich-Ungarn, 740 †
Kilimanjaro—
Hochregionen des Kilimandscharo, Forschungen in den: F. Jaeger, 346 †
Kimberley—
Diurnal Variation of Level at Kimberley, Preliminary note on: J. R. Sutton, 345 †
King, B., and T. Okey: Italy To-day, 182 §, 207 †
King, J., W. G. Lawes of Savage Island and New Guinea, 192 §, 217 †
King Karl's Land—
Fossilen Hölzer von Kong Karls Land: W. Gothan, 215 †
Kirchhoff, A., und F. Lampe, Erdkunde für Schulen, 443 §
Kirkuk, Kurdistan, 375
Kirkwood, J. E., Desert scenes in Zacatecas, 611 †
Kissenbarth, —, Expedition in Brazil, 336
Kivu-Ruwenzori Region, International frontiers in, 722
Klautzsch, A., Kalifornische Erdbeben vom 18. April 1906..611 †
Knebel, W. von, Disaster to expedition in Iceland, 1907..78
Knowles, W. H., Excavations at Corstopitum Northumberland, 92 †
Knysna, forest of, Cape Colony, 712
Knysna, Note on a journey to: A. W. Rogers, 609 †
Kobbe, — v., Angenäherte Darstellung des Hauptbogens in der Merkatorkarte, 98 †
Kober, R., Schulwandkarte des Herzogtums Schlesien, 350 †
Koch-Grünberg, T., Zwei Jahre unter den Indianern, 737 †
Koehler, R., Echinodermes provenant des campagnes du yacht *Princesse Alice*, 216 †
Kolbe, F., Einführung der Pflugkultur in die Wirtschaft des Negers in Togo und Deutschostafrika, 346 †
Kolbe, H., Südpolar-kontinenttheorie nebst Bemerkungen über tiergeographische Verhältnisse auf der Südhemisphäre, 471 †
Königsmarck, Count H. von, A German Staff Officer in India, 184 §, 464 †
Kopopo, Pool near, Kafue river, 140
Kordofan province, Notes on: W. Lloyd, 249 *
Korea—
Journeys through Korea: B. Kotô, 465 †
Korhonen, V. V.: *see* Heinrichs, A.
Kotô, B., Journeys through Korea, 465 †
Krah, C., Insel Runö und ihre Bewohner, 342 †
Krebs, N., Klagenfurter Becken, 606 †
Krebs, W., Rätsel des 10 Juli 1907 in ihrem geophysikalischen Zusammenhange, 473 †
Krüger, P., Andine Gebiet Patagoniens Zwischen 40° und 44° S. (map), 353 †; Patagonischen Anden, 737 †
Küchler, C., Wüstenritte und Vulkanbesteigungen auf Island, 321 §
Kumdan glacier, Karakoram, 651
Kumm, K., Uebersicht Durchquerung von Afrika durch den Sudan (map), 353 †
Kümmel, H. B., Geological Section of New Jersey, 470 †
Kunene river, South-West Africa, 510
Kunz, G. F., Hudson-Fulton Celebration of 1909..611 †
Kürchhoff, D., Alte und neue Handelsstrassen . . . in West-Afrika, 469 †
Kurdistan—
Journeys in Kurdistan: B. Dickson, 357 *
Kurdish Tribes of Ottoman Empire: M. Sykes, 91 †
People of, 361
Kuru river, Bhutan, 30
Küstenland—
Wasserschlingers von Dane bei St Kanzian im Küstenlande, Erforschung des: F. Mühlhofer, 606 †
Kyunka river, Bhutan, 19

L.

Labbé, P., Avec les Lamas de Sibérie, 210 †; Province d'Arkhangelsk, 90 †
Labrador—
Country and people: W. T. Grenfell and others, 470 †
Discovery, exploration, and development: W. G. Gosling, 736 †
In an unknown land: E. C. Robinson, 212 †, 330 §

Lagden, Sir G., Basutos; mountaineers and their country, 468 †
Lakes—
Evaporation over Lakes and Reservoirs, Studies on phenomena of: F. H. Bigelow, 88 §, 99 †
Ramparts in Minnesota: R. F. Griggs, 81
Temperature oscillations in lakes: E. M. Wedderburn, 613 †
Temperaturmessungen in tiefen Seen in ihrer Beziehung zur klimatologie: Dr. Halbfass, 348 †
Lampe, F.: *see* Kirchoff, A.
Lamplugh, G. W., Geology of Isle of Man, 92 †; remarks on "Sand-dunes of Libyan Desert," 392; remarks on "Some Recent Changes in Course of the Trent," 577
Lanciani, R., Wanderings in Roman Campagna, 462 †, 582 §
Lang, J., Land of golden trade (West Afrika), 469 †, 587 §
Lange Berg, South-West Africa, Flora of, 489, 490
Langheld, W., Zwanzig Jahre in deutschen Kolonien, 466 †
Lang-marpu-chhu, Bhutan, 19
Languages—
Sprachstamme des Erdkreises · F. N. Finck, 739 †
Languedoc—
Bas-Languedoc en 1626: L. Malvialle, 730 †
Lanzoni, A., La Mesopotamia, 608 †
Laos—
Chemins de fer du Laos: Aymé-Martin, 607 †
Maps: Carte des communications du Laos (Service Géo. de l'Indo-Chine), 222 †
La Paz, Bolivia, 514
Larminat, M. de, Determination of height of Mount Huascaran, 458
Latham, B., Chapter in History of Croydon, 91 †; Influence of Soil and Groundwater upon Health, 474 †; Percolation, Evaporation, and Condensation, 349 †
Laurence, H., Little folk in many lands, 475 †
Laut, A. C., Canada, Empire of the North, 469 †, 590 §
Lawes, W. G., of Savage Island and New Guinea: J. King, 192 §, 217 †
Lawson, A. C., California Earthquake of April 18, 1906. Report of State Earthquake Investigation Commission, 212 †
Leblond, M.-A., Grande île de Madagascar, 467 †
Leca, C. de, Voyage à travers le Sahara, 735 †
Le Cointe, P., Carte du cours de l'Amazone, 742 †
Lee, G. W.: *see* Murray, J.
Lee, W. T., and G. H. Girty, Manzano Group of Rio Grande Valley, New Mexico, 737 †
Legendre, A. F., Far West Chinois. Races Aborigènes. Les Lolos, 464 †
Legendre, R., Recherches physico-chimiques sur l'eau de la côte, à Concarneau, 89 †
Lehututu, Kalahari, 166
Leicestershire—
Geology of Leicestershire and South Derbyshire Coalfield: C. Fox-Strangways, 208 †
Leiter, H., Frage der Klimaänderung während geschichtlicher Zeit in Nordafrika, 468 †
Leith, C. K.: *see* Hise, C. R. van
Lemoine, P., Conclusions d'ordre géographique tirées de l'étude des Mollusques d'Afrique, 466 †; Tremblements de terre de Provence, 89 †
Léon—
Excursiones en la provincia de Léon: D. J. Ciria y Vinent, 90 †
Léotard, J., Notice sur Marseille et les Bouches-du-Rhône, 341 †
Le Roy, P. L., Relation des aventures arrivées à quatre matelots russes près de l'Isle déserte d'Ost-Spitzbergen, 219 †
Leslie, J., De origine, moribus, et rebus gestis Scotorum, 219 †
Le Vasseur, N., Joseph Bureau, explorateur canadien, 474 †
Leverett, F., Weathering and Erosion as Time Measures, 215 †
Lewis, G. G., Typical school journeys 475 †, 716 §
Leyte, Island of—
Geological Reconnaissance of Island of Leyte: G. J. Adams, 608 †
Liberia—
Franco-Liberian frontier, 723
Interne Leben der Eingeborenen Liberias, Einiges über das: H. Fischer, 467 †
Liberianische Küstenfahrten und Urwaldwanderungen: J. Scherer, 610 †
Tour in Liberian Hinterland: B. Wallis, 285 *
Library Catalogue—
Subject-Index of London Library C L. H. Wright, 614 †
Libyan Desert—
Reise . . . in der Libyschen Wüste und nach Ober-Aegypten, in 1820 und 1821 . . . H. Freiherr von Minutoli, 219 †
Sand-dunes: H. J. L. Beadnell, 379 *
Liddell, T. H., China: its Marvel and Mystery, 184 §, 209 †
Liebert, E., Aus dem nordalbanischen Hochgebirge, 462 †
Light—
Lichtintensitäten in grossen Seehöhen M. Samoe, 739 †
Liguria—
Vegetazione delle isole liguri di Gallinaria . . . e Tinetto: A. Béguinot, 90 †

Lima, O., Le Brésil. Ses Limites actuelles; ses voies de pénétration, 97 †
Lindgren, W.: *see* Hayes, C. N.
Lindhard, J., Danish North-Eastern Greenland Expedition, 1906–8. Provisional Results, 541 *
Lindley, W. H., Report on Waterways of France, Belgium, Germany, and Holland, 341 †
Little, A., Across Yunnan, 410 §
Little folk in many lands: H. Laurence, 475 †
Liverpool bay—
Maps: Chart of Liverpool Bay (Mersey Docks and Harbour Board), 479 †
Lloyd, W., Notes on Kordofan Province, 249 *
Lockyer, W. J. S., Solar Physics Committee; Discussion of Australian Meteorology, 70 §
Loeries Fontein, South-West Africa, 489
Lofu river, course of, 143
Loire—
Inondations de la Loire supérieure: U. Rouchon, 730 †
Lolos—
Far West Chinois. Races Aborigènes. Les Lolos: A. F. Legendre, 464 †
Lomond, Loch—
Contour Relief-model of district: R. F. Gwinnel, 741 †
Origine glaciaire du Loch Lomond et du Loch Tay en Écosse: G. Eisenmenger, 92 †
London—
Maps: Contour relief models of country north and south of London: G. R. C. Feigerl, 351 †; Contoured map of Environs of London: J. Bartholomew, 351 †; New map of Metropolitan Railways, etc.: Stanford & Co., 476 †
London Library, Subject-Index of: C. L. H. Wright, 614 †, 714 §
Longitudes—
Längenunterschiedmessungen zweiter Ordnung: L. Andres, 215 †
Longstaff, T. G., Glacier Exploration in Eastern Karakoram, 622; Himalayan Expedition, 1909..64
Lope de Vega: L. Hargrave, 471 †
Lop-nor, Strands of, 407
Lorentz, A. H., Ascent of Snowy range in Dutch New Guinea, 724; expedition in New Guinea, 336
Louise, Lake—
Guide-book to Lake Louise Region: W. D. Wilcox, 329 §
Lowndes, W. T., Bibliographer's manual of English literature, 219 †
Lualaba river, course of, 143
Luangwa river and valley, Fauna and Flora, Rhodesia, 133–136
Luapula river, course of, 143
Lucerna, R., Glazialgeologische Untersuchung der Liptauer Alpen, 606 †
Lüderitzbucht, Diamond fields near, 198
Lüderitz Land—
Desert of, 502
Diamond deposits of Lüderitzland: H. Merensky, 94 †
Ludolphus de Suchen, Descriptio terræ sanctæ itineris ejus Hierosolymitani 219 †
Lunet de Lajonquière, E., Rapport sommaire sur une mission archéologique au Cambodge, etc., 343 †
Lunzer, Lake—
Eis des Lunzer Unter- und Obersees, Studien über das: G. Götzinger, 606 †
Lunzer seen: G. Götzinger, 88 †
Lut desert, Persia, 398
Lütgens, R., Observations on Evaporation in Atlantic Ocean, 84; Ueber den Ausbruch des Vulkans Vallarica in Süd-Chile, 612 †; Vorläufiger Bericht über eine ozeanographische Forschungsreise, 216 †
Luxemburg—
Deutschen Orts- und Gewässernamen der belgischen Provinz Luxemburg: N. Warker, 341 †
Lyde, L. W. (*see also* Bartholomew, J. G.), remarks on "Geographical Factors that control Development of Australia," 678; Teaching of geography, 350 †
Lydekker, R., Cambridge County Geographies. Hertfordshire, 91 †
Lyons, H. G., Rains of Nile Basin and Nile Flood of 1907 and 1908..95 †, 735 †; Scope of Modern Geography, 611 †

M.

McAldowie, A. M., Life History of River Trent, 92 †
McCall, Hon. J., Tasmania: its Resources and Future, 737 †
McConnell, R. G., Whitehorse Copper Belt, Yukon Territory, 610 †
McCormick, Cyrus H., his life and work H. N. Casson, 217 †
McDonald, D. F. *see* Calkins, F. C.
Macdonald, Sir R., remarks on "Journeys in Bhutan," 40
Macedonia—
Makedonische Fahrten: A. Struck, 463 †
Mackay, K., Across Papua, 191 §, 214 †
Mackenzie Basin, Great: E. J. Chambers, 469 †
Mackie, Mr., Report on Trade of Angola, 1908..723
McMichael J. A., Method of modelling in relief by means of serial sections from contoured maps, 100 †
McNab, R., Murihiku; history of South Island of New Zealand, etc., 214 †
Macquarie river—
Physiography . . . of Watershed of Macquarie River L. F. Harper, 213 †
MacQueen, P., In Wildest Africa, 187 §, 345 †

Madagascar—
Ethnographie de Madagascar: A. et G. Grandidier, 467 †
Grande île de Madagascar: M.-A. Leblond, 467 †
Malgaches, Origine Africaine des: G. Ferrand, 95 †
Or à Madagascar: Marquet, 467 †
Statistiques Générales, 610 †
Tritriva, Note sur le remarquable volcan de: A. Bourdariat et H. Johnston-Lavis, 95 †
Maddren, A. G.: *see* Moffit, F. H.
Madeira river—
Railway between Madeira and Mamore, Progress of Construction, 597
Madsen, V. H. O., and M. J. Sand, Breddebestemmelser udførte i Aarene 1890-92 efter Horrebows metode, 89 †
Madu-chu, Bhutan, 26
Magallanes—
Censo Jeneral de Poblacion . . . del Territorio de Magallanes: L. N. Avaria, 589 §
Magnetic Declination, Earliest Values of: L. A. Bauer, 473 †
Magnetic Research expedition in China under D. C. Sowers, 722
Magnetism—
Non-magnetic Gas Engine of *Carnegie*: J. Craig, 613 †
Mahaffy, A., Report on Gilbert and Ellice Islands, 455
Maiden, J. H., Sir J. Banks, "Father of Australia," 474 †
Main river—
Siedelungen am Maindreieck: A. Grubert, 341 †
Maine—
Peat Deposits of Maine: E. S. Bastin and C. A. Davis, 97 †
Underground Waters of Southern Maine: F. G. Clapp and W. S. Bayley, 97 †
Maitre, H., Exploration in Cambodia and Annam, 593; Régions Moï du sud Indo-Chinois, 66 §
Makalakari, Trek in Unknown Country north of the: A. W. Hodson, 609 †
Malaspina, A., and others, Viaje politico-cientifico alrededor del mundo por las corbetas Descobierta y Atrevida, 219 †
Malaspina glacier, Alaska, 271
Malavialle, L., Bas-Languedoc en 1626.. 730†
Malay archipelago—
Through Malay Archipelago: E. Richings, 586 §
Malay peninsula—
Maps: Pahang, Federated Malay States, 741 †
Malaya—
Adventures of John Smith in Malaya, 1600-1605: A. Hale, 66 §
Im Malaiischen Urwald und Zinngebirge: W. Wolff, 210 †
Mission archéologique . . . dans la presqu'île malaise: L. Lunet de Lajonquière, 343 †
Man—
Migration of Man: G. F. Scott-Elliot, 85 §, 216 †
Races of Man and their Distribution: A. C. Haddon, 192 §, 217 †
Man, Isle of—
Geology of Isle of Man; G. W. Lamplugh, 92 †
Isle of Man: A. Herbert, 181 §
Manasarowar Lake, Tibet, 328
Mancha—
Causas de la esterilidad de la Mancha D. F. V. y Coreta, 732 †
Manchuria—
Maps: "Südliche Mandschurei zum Verfolg der Operationen im russisch-japanischen Kriege, 222 †
Mandans, Study of their Culture, etc.: G. F. Will and H. J. Spinden, 470 †
Manitoba: Wheat production, 54
Mantegazza, V., Il Benadir, 734 †
Maps—
International Map Conference, remarks by L. Darwin, 87
Land Map of World, Account of New: B. J. S. Cahill, 99 †
Map reading and Imagination: J. B. Reynolds, 100 †
New Land Maps of World: S. Smith, 472 †
Maps, New—
Africa, 102, 222, 352, 477, 616, 742
America, 102, 222, 353, 478, 618, 742
Asia, 101, 221, 352, 477, 616, 741
Australasia and Pacific Islands, 354, 618
Europe, 100, 220, 350, 475, 614, 740
General, 103, 222, 354, 618, 744
Pacific Ocean, 743
Polar Regions, 222, 743
Marbut, C. F., College Unit in Physical Geography, 100 †
Margerison, S., Vegetation of some disused Quarries, 717 §
Marinelli, O., Il limite climatico delle nevi nel gruppo del M. Canin (Alpi Giulie), 341 †
Marini, S., Quelques considérations sur le programme pour l'Exploration internationale de l'Océan Atlantique et de la Méditerranée, 216 †
Markham, Sir A. H., remarks on "Notes on Determination of Position near the Poles, 303
Markham, Sir C. R.: *see* Keane, A. H.
Marloth, R., Das Kapland, insonderheit das Reich der Kapflora, das Waldgebiet und die Karroos, 211 †, 711 §
Marquardsen, H., Saharisch-Sudanische abflusslose Gebiet, 353, †
Marquet, —, L'or à Madagascar, 467 †
Marr, J. E., Cambridge County Geographies. Westmoreland, 181 §
Marseilles—
Notice sur Marseille et les Bouches-du-Rhône: J. Léotard, 341 †

Marshall, P., Commercial Geography of New Zealand, 612 †; Crater of Ngauruhoe, 737 †
Marshes—
Bildung der Moore: H. Potonié, 739 †
Marsters, V. F., Informe sobre la Costa sur del Peru, 737 †
Martel, E.-A., Géographie préhistorique de la France, 607 †; Ground-water or subterranean rivers in Karst region, 601; Sur l'hydrologie souterraine du massif de Penè-Blanque ou Arbas, 607 †
Martiny, R., Kulturgeographie des Koblenzer Verkehrsgebietes, 123 §, 342 †
Martonne, E. de, Local winds in South of France, 718; Sur l'inégale répartition de l'érosion glaciaire dans le lit des glaciers alpins, 338 §, 613 †; Traité de géographie physique climat, etc., 473 †
Martyr, Peter, De orbe novo, Petri Martyris Anglerii, 219 †
Masai, Die: M. Merker, 734 †
Masarwa or Bushmen tribe, Kalahari, 170
Masterman, E. W. G., Studies in Galilee, 465 †
Mathes, F. E., on Glacial Erosion, 153
Mathuisieulx, Vicomte H. M. de, La Tripolitaine, 468 †
Matthew, G. F., Geological Cycles in Maritime Provinces of Canada, 610 †
Matto Grosso City, Brazil, 525; Longitude, 165
Maudslay, A. P., True History of Conquest of New Spain, Vol 1, Bernal Diaz. Translated by, 68 §
Maugham, R. C. F., Zambezia, 468 †
Maunsell, F. R., remarks on: "Journey in North-Western Arabia," 246; "Journeys in Kurdistan," 378; "Mesopotamia: Past, Present, and Future," 16
Maurer, J., Aus langjährigen Aufzeichnungen des Schweizer Föhns, 343 †
Mauritania—
A travers la Mauritanie occidentale: A. Gruvel et R. Chudeau, 467 †
Pacification of, 197
May, E. S., Introduction to Military Geography, 717 §
Mchinga escarpment, Rhodesia, 136
Mecklenburg—
Siedlungen des Warnowgebietes in Mecklenburg: A. Schulz, 341 †, 447 §
Mecklenburg, Duke of, Ins innerste Afrika, 345 †, 437 §
Mediterranean—
Exploration internationale . . . de la Méditerranée, Programme pour l': S. Marini, 216 †
Phéniciens . . . dans de bassin de Méditerranée: M. Schwab, 732 †
Mees, J., Mouvement Scientifique en Belgique 1830–1905. Sciences Géographiques, 88 †
Meinardus, O., Antarktische Festland (map), 222 †
Meinhard, F., Verkehrswege über die Alpen, 340 †
Mekong—
Surveys in Shan States and Mekong Basin: R. H. Phillimore, 721
Mekran, Baluchistan, 594
Melin, L. R. de, Dans la Région du-Tchad avec la Mission Tilho, 468 †
Melladew, H., Sport and Travel Papers, 192 §
Mendenhall, W. C., Colorado Desert, 212 †; Some Desert Watering Places in South-Eastern California and South-Western Nevada, 470 †
Mentawei islands—
Mentawei-eilanden: J. B. Neumann, 608 †
Merchier, A., Voyage de Télémaque, 731 †
Merensky, H., Diamond deposits of Luderitzland, German South-West Africa, 94 †
Merian, M., Topographia Helvetiæ Rhætiæ et Valesiæ, 219 †
Merker, M., Die Masai, 734 †
Mersey—
Navigation of River Mersey, 1908, Report on present state of: Sir G. S Nares, 92 †
Mesa Verde National Park, Antiquities, of: J. W. Fewkes, 346 †
Mesopotamia—
Garden of Eden and Ur of the Chaldees, letter from H. Rassam on, 459
La Mesopotamia: A. Lanzoni, 608 †
Past, Present, and Future: Sir W. Willcocks, 1 *
Photographs of: Sir W. Willcocks, 104 †
Reise in Mesopotamien: F. Sarre, 465 †
Trade and railways, 13
Trade of Mesopotamia—Noah's Flood, letter from W. Willcocks on, 459
Messina—
Earthquake: W. H. Hobbs, 90 †
Earthquake of 1908, Messina and Reggio before and after the, 731 †
Messina e Reggio nella Storia, 342 †
Meteorology—
Anschauungen der Kirchenväter über Meteorologie: I. Hoffmann, 349 †
Anticyclonic belt of Northern hemisphere: H. E. Rawson, 613 †
Atmosphere, Upper, Present State of our knowledge of: E. Gold and W. A. Harwood, 349 †
Atmospheric Pressure, Note on Long-period Variations of: F. Omori, 614 †
Bewolkung, Einige Studien über die: A. S. Steen, 348 †
Centres d'action de l'atmosphère, Quelques recherches sur les: H. H. Hildebrandsson, 613 †
Feuchtigkeit und Temperatur der Luft im Gebirge, etc.: J. Schubert, 614 †
Obere Inversion: A. Schmauss, 349 †
Observations faites dans les différentes Couches de l'atmosphère . . . à bord

Meteorology—*continued.*
du bateau *Neptune*: M. M. Rykacev, 348 †
Percolation, Evaporation, and Condensation: B. Latham, 349 †
Température, Lois de distribution de la, avec la hauteur aux diverses latitudes, etc.: L. Teisserenc de Bort, 348 †
Temperature oscillations in lakes and in ocean: E. M. Wedderburn, 613 †
Upper Air, Exploration of, by means of Kites and Balloons: W. R. Blair, 614 †
Vertical temperature gradients of Atmosphere: W. J. Humphreys, 614 †
Meunier, A., Carte de la Côte d'Ivoire, 353 †
Mexico—
American Egypt; Record of Travel in Yucatan: C. Arnold and F. J. Frost, 189 §, 212 †
List of Works in New York Public Library relating to Mexico, 470 †
Mexico: C. R. Enock, 188 §
Mexico; wonderland of the South: W. E. Carson, 470 †, 590 §
Mixteca country in State of Oaxaca: J. Birkinbine, 346 †
New Spain, True History of Conquest of, Vol. 1: Bernal Diaz del Castillo, translated by A. P. Maudslay, 68 §, 736 §
Nuestros límites con los Estados Unidos del Norte: F. de P. Ponce, 611 †
Volcans du Méxique: B. de Inkey, 346 †
Meyer, H., Deutsche Kolonialreich, 346 †
Mghairah wells, Arabia, 236
Mialaret, H., et A. Fraysse, Contribution à l'étude du Climat de la Nouvelle-Calédonie, 82 §. 98 †
Michael Sars, Norwegian Fishery Investigations on board of, 179, 601
Michigan—
Wheat production, 45
Middlemiss, C. S., Gondwanas and Related Marine Sedimentary Systems of Kashmir, 93 †
Middlesex—
Highways and Byways in Middlesex: W. Jerrold, 181 §, 208 †
Middleton, R. E., and others, Treatise on surveying, 472 †
Mielert, F., Aus dem östlichen Thessalien, 342 †; Eindrücke aus dem Kernlande der Kabylen Algeriens, 466 †
Mielke, R.: *see* Friedel, E.
Migration of Man: G. F. Scott-Elliot, 85 §, 216 †
Mildbraed, J., Vegetationsverhältnisse der Centralafrikanischen Seenzone vom Viktoria-See bis zu den Kiwu-Vulkanen, 345 †
Mill, H. R., Rainfall of British Isles, 92 †
Miller, J., and W. Miller, Practical geography for secondary and supplementary schools, 218 †, 716 §
Miller, J. H.: *see* Carruthers, D.
Mimika river, Dutch New Guinea, 454
Minnesota—
Divided Lakes in Western Minnesota R. F. Griggs, 81 §, 347 †
Wealth of Minnesota: E. Van Dyke Robinson, 470 †
Wheat production, 43
Minutoli, H. Freiherr von, Reise zum Tempel des Jupiter Ammon in der Libyschen Wüste und nach Ober-Aegypten 1820 und 1821..219 †
Mississippi, floods of, 58
Missouri, floods of, 57, 58
Mitchelstown Caves, co. Tipperary: C. A. Hill and others, 209 †
Mo-chhu or Poonakha-chhu, Bhutan, 32
Models—
Method of modelling in relief by means of serial sections from Contoured Map: J. A. McMichael, 100 †
Moffit, F. H., and A. G. Maddren, Mineral Resources of Kotsina-Chittina Region, Alaska, 469 †
Moï tribe, Cambodia and Annam, 593
Moisel, M.: *see* Sprigade, P.
Moisson, P., Mouvement de la population du département des Hautes Alpes au XIX^e^ siècle, 607 †
Mokalahari tribe, Kalahari desert, 170
Molepolole, Kalahari, 166
Moll, —, Forêt et Savanes Congolaises, 345 †
Möller, M., Graphische Lösung von Aufgaben aus der astronomische Erdkunde, 98 †
Molonglo river, Australia, 320
Molyneux, A. J. C., On Karroo System in Northern Rhodesia, 95 †
Monaco, Oceanographical Museum at, 339; opening of, 558
Monaco, Prince of, Address on opening Oceanographical Museum, 562
Monckton, H. W., and R. S. Herries, Geology in the field, 463 †
Moncrieff, Sir C. S., Egyptian Irrigation, 425 *; remarks on "Mesopotamia: Past, Present, and Future," 17
Mong Yawng plain, Shan States, 721
Mongolia—
Japanese expedition to Chinese Turkestan and Mongolia, 448
North-West, Expedition to: D. Carruthers, J. H. Miller, and M. P. Price, 333
Montana—
Geological reconnaissance in Northern Idaho and North-Western Montana, F. C. Calkins and D. F. McDonald, 736 †
Geology and Water Resources of Great Falls Region: C. A. Fisher, 97 †
Geology of Great Falls Coalfield: C. A. Fisher, 97 †
Mopane tree, Rhodesia, 134
Morel, E. D., Great Britain and the Congo, 188 §, 210 †
Moritz, E., Die Insel Rõm, 342 †

Morocco—
Geological researches in: M. Gentil, 722
Journeys in Western Morocco: M. Gentil, 196
Maps: Atlas Marocain: L. Gentil et M. Chesneau, 617†; Carte du Maroc (Service Geog. de l'Armée), 478†; Region de Casablanca (service Géo. de l'Armée), 742†
Voyages au Maroc: A. Brives, 734†
With Mulai Hafid at Fez: L. Harris, 187§, 211†
Morrison, Mount—
Ascent of: J. H. Arnold, 93†
Mort, F. (*see also* Deas, J.), Elementary practical geography for middle forms, 739†
Mosquito or Man? Sir R. Boyce, 349†, 445§
Moss, A. M., Trip into Interior of Peru, 70§
Mossamedes, Angola, Flora and Climate of, 504, 505
Moszkowski, M., Auf neuen Wegen durch Sumatra, 465†, 585§; Reisen in Ost- und Zentral-Sumatra, 608†
Mountains—
Altitudes and first ascents, World's highest: C. E. Fay, 614†
Aménagement des Montagnes, Premiere étape de l'Association Centrale pour: P. Descombes, 341†
Cycle of Mountain Glaciation: W. H. Hobbs, 146*, 268*
High Mountain Ascents: E. S. Balch, 100†
Nordappenin und Westkarpathen, eine morphologische Parallele: L. R. v. Sawicki, 99†
Moura, G., Exploracão dos Rios Feio e Aguapehy, 328§
Mühlhofer, F., Erforschung des Wasserschlingers von Dane bei St. Kanzian im Küstenlande, 606†
Mulai Hafid at Foz, With: L. Harris, 187§, 211†
Müller, A., Zur Theorie der Entstehung der Tiden, 100†
Muller, G. P., Voyages et découvertes faites par les Russes le long des côtes de la Mer Glaciale et sur l'Océan Oriental, 219†
Murray, H.: *see* Weiss, F. E.
Murray, J., Handbook for travellers in India, Burma, and Ceylon, 210†; and G. W. Lee, Depth and marine deposits of Pacific, 738†
Murray, Sir J., obituary of A. Agassiz, 602; Oceanographical expedition in *Michal Sars*, 601
Musil, A., Nord-Arabien, Vorbericht über die Forschungsreise, 464†, 579§
Mylius, H., Geologischen Verhältnisse des Hinteren Bregenzer Waldes, 606†
Mylius-Erichsen, L., Greenland Expedition founded by, 541
Myrica, P. de, De la Nouvelle-Calédonie aux Iles Hébrides, 213†
Mzara district, Morocco, 196

N.

Nafud sand desert, Arabia, 238
Nahrwan canal, Mesopotamia, 8
Nain Singh's work in Tibet, 595
Nakamura, S., and C. Hiratsuka, Some Altitude Measurements in Aso Volcano, 93†
Namaqualand, flora of, 485, 491
Nance, R. M.: *see* Speight, E. E.
Nansen, F.: *see* Helland-Hansen, B.
Nares, Sir G. S., Report on present state of Navigation of River Mersey, 1908 92†
Narrabeen, Evidence of Recent Submergence of Coast at: S. W. E. David, 612†
Natal—
Mining Industry, Report for 1907, 1908: C. J. Gray, 467†
Naturalist, Three Voyages of a: M. J. Nicoll, 350†
Navigation—
Art of: M. Cortes, 218†
Text-book of navigation and nautical astronomy: A. P. Williamson, 215†
Neave, S. A., Naturalist's travels on Congo-Zambezi Watershed, 132*
Nebraska—
Surface Water Supply of Nebraska: J. C. Stevens, 470†
Neckar basin, Württemberg, 77
Nefud: *see* Nafud
Ness, Loch—
Current Meter in Loch Ness, Observations with: E. M. Wedderburn and W. Watson, 463†
Neuchâtel, Geographical Society of, Anniverary Meeting, 602
Neuhauss, R., Journeys in German New Guinea, 200
Neumann, J. B., De Montawei-eilanden, 608†
Neu Pommern—
Hamburger Südsee-Expedition, Erste Durchquerung von Neu-Pommern, 471†
Maps: Aufnahmen auf der Gazelle Halbinsel: K. Sapper, G. Frederici, W. Wernicke, 743†
Nevada—
Desert watering-places in . . . S.W. Nevada: W. C. Mendenhall, 470†
Geology and Ore Deposits of Goldfield, Nevada: F. L. Ransome and others, 736†
Neveu-Lemaire, M., Lagos de los altiplanos de la América del Sud, 171†
New Amsterdam—
Flora und Vegetation von . . . Neu Amsterdam: H. Schenck, 348†
Gesteine von . . . Neu Amsterdam: R. Reinisch, 348†
New Caledonia—
Climat de la Nouvelle-Calédonie,

New Caledonia—continued.
Contribution à l'étude du: H. Mialaret et A. Frazans, 22 §, 26 †
Nouvelle-Calédonie aux Iles Hébrides: P. de Myrica, 213 †
Rainfall of New Caledonia, 82
Newfoundland—
Mineral Wealth of Islands of Newfoundland and Jamaica: A. E. Outerbridge, 611 †
New Guinea—
Across Papua: K. Mackay, 191 §, 214 †
Boundary between German and Dutch New Guinea, L. Schultze's expedition for survey of, 337
Dutch—
Ascent of Snowy range by Dr. Lorentz, 724
De jongste opvaart der Mambèrámo, 1909: F. L. Rambonnet, 612 †
Drie opvaarten der Mambèrámo: G. P. Rouffaer, 612 †
Expeditions in, 336; C. G. Rawling's expedition, 454
Land en volk van Zuid Nieuw-Guinea: A. J. Goosszen, 213 †
German—
Deutsch-Neuguinea. Deutsche Marine-Expedition, 1907–09..471 †
Eine Fahrt auf den Kaiserin Augustafluss, 213 †
Journeys in, R. Neuhauss', 200
Maps: Toricelli-Gebirge (Kaiser Wilhelm-Land) und das ihm vorgelagerte Hügelland: P. C. Hemel und P. J. Reiber, 354 †
New Hebrides—
Nouvelle-Calédonie aux Iles Hébrides: P. de Myrica, 213 †
New Jersey—
Geological Section of New Jersey: H. B. Kümmel, 470 †
Marsh and Pond Vegetation on North Coast of New Jersey: J. W. Harshberger, 453 §, 736 †
New Mecklenburg—
Lotungen S.M.S. *Planet* bei Neu-Mecklenburg und den Salomo-Inseln: Kommdts Nippe und Trotha, 473 †
Neu-Mecklenburg: K. Sapper, 213 †
New Mexico—
Manzano Group of Rio Grande Valley. W. T Lee and G. H. Girty, 737 †
New Siberia islands, Arctic, 72
New South Wales—
Geological Notes on Country behind Jervis Bay: H. I. Jensen, 612 †
Maps: New South Wales, showing Shires and Municipalities: H. E. C. Robinson, 354 †
New York—
History of city of New York in seventeenth century: S. van Rensselaer, 212 †
Van Rensselaer Bowier Manuscripts; being letters of Kiliaen van Rensselaer, 1630–1643..212 †
New Zealand—
Commercial Geography of New Zealand. P. Marshall, 612 †
Dominion of New Zealand (All Red Series): Sir A. P. Douglas, 71 §
Finest Walk in the World: B. E Baughan, 612 †
Forestry in New Zealand: W. C Kensington, 612 †
Geological Survey Office, Annual Report, 336
Great Wairarapa; a Lost River: H. Hill, 599 §, 737 †
Murihiku; history of South Island of Zealand, etc.: R. McNab, 214 †
Neuseeland: M. F. Blasneck, 191 §
Ngauruhoe, Crater of: P. Marshall, 737 †
Physical Features of New Zealand · J M. Bell, 612 †
Scenery preservation, Reports on: W C. Kensington, 612 †
Survey operations for 1908–9, Report on: T. Humphries, 737 †
Waimarino District, Higher, Report on Botanical Examination of: E. P Turner, 737 †
Ngauruhoe, Crater of, P. Marshall, 737 †
Nicoll, M. J., Three voyages of a naturalist, 350 †
Niedeck, P., Cruises on Bering Sea, 611 †
Nieger, J., Observations astronomiques dans le Sahara algérien, 96 †
Niermeyer, J. F., De onderzeese vorm van Celebes, 608 †
Nieuwe Fontein, South-West Africa, 490
Nieves Penitentes in Himalayas, 125, 130
Niger, Ancient hydrography of, 67
Nigeria—
Boundary between Cross river and Yola: Captain von Stephani, 197
Northern—
Maps. Northern Nigeria (Geog. Section, General Staff), 353 †
Report on results of Mineral Survey 1906–07: W. R. Dunstan, 95 †
Southern—
Maps: Central and Eastern Provinces of Southern Nigeria, 1910: W. H Beverley, 617 †
Report on results of Mineral Survey. W. R. Dunstan, 734 †
Nile—
Aristotle's Buch, 'Ueber das Steigen des Nil': J. Partsch, 95 †
Barrages and dams on Nile, 426
Flood in 1908, Consideration of Magnitude of: H. M. Dowson, 345 †
Maps: Topographical survey of Nile (Survey Dept., Cairo), 478 †
Origin of Nile Valley and Gulf of Suez: J. Ball, 596 §, 609 †
Rains of Nile Basin and Nile Flood of 1907 and 1908: H. G. Lyons, 95 †, 735 †

Nile—*continued.*
Refraction across Nile Valley: B. F. E. Keeling, 99 †
Sadd-blocks of upper Nile, 185
Volumes discharged by Nile during 1905 and 1906, Measurement of: E. M. Dowson, 345 †
Nimrud Dagh, Kurdistan, 358
Nippara in Musashi, Limestone Caves of: T. Wakimizu, 94 †
Nippe, —, und — v. Trotha, Lotungen S.M.S. *Planet* bei Neu-Mecklenburg und den Salomo-Inseln, 473 †
Niya river, Chinese Turkestan, 402
Nölke, F., Entstehung der Eiszeiten, 99 †; Neue Erklärung der Entstehung der irdischen Eiszeiten, 348 †; Ueber Simroths neue Begründung der Pendulationstheorie, 613 †
Norbu-gang, Bhutan, 29
Nordenskjöld, O., Beobachtungen über Eisformen und Vergletscherung der antarktischen Gebiete, 214 †; Polarwelt und ihre Nachbarländer, 214 †; Praktische Verwertung der Polarländer und die Spitzbergenfrage, 214 †
North, Roads to the: J. Fairgrieve, 91 †
North sea—
Biddulphia sinensis in North Sea Waters: C. H. Ostenfeld, 738 †
Fishery and Hydrographical Investigations in North Sea and Adjacent Waters. Second and Fourth Reports: D. W. Thompson, 433 §, 473 †
Jährlichen Schwankungen der Wassermassen im Norwegischen Nordmeer, etc.: B. Helland-Hansen und F. Nansen, 738 †
Northumberland—
Excavations at Corstopitum: W. H. Knowles, 92 †
North-West Passage, Strange and Dangerous Voyage of Captaine Thomas James in his intended Discovery of, 218 †
Norton, Hon. A., Jardines' Expedition from Rockhampton to Cape York in 1864..348 †
Norway—
Austernbassins in Norwegen: B. Helland-Hansen, 732 †
Coastal current, 176, 433
Geologiske og geografiske bemerkninger om det landskap man ser ut over fra Holmenkollen ved Kristiania: H. Reusch, 90 †
Kvartær-Studier i den sydøstlige del af vort land: P. A. Øyen, 90 †
Maps: Kystkarter (Norges Geog. Opmaaling), 479 †; Topografisk Kart over Kongeriget Norge (Norges Geog. Opmaaling), 477 †
Nogen bemerkninger om indsjøers dannelse i Skiensvasdraget: H. Reusch, 732 †
Norwegian fishery and marine investigations, Report on: J. Hjort, 179 §, 216 †
Norwegian Sea: B. Helland-Hansen and F. Nansen. Review by L. W. Collet, 172
Norwich—
Maps: Plan of Norwich based upon Ordnance Survey Map: J. G. Bartholomew, 740 †
Nosop river, Kalahari, 170
Noumea, New Caledonia, Meteorological Observations at, 82
Nuba tribes, Kordofan, 261–264
Nubia—
Survey Work in Lower Nubia, 1908–1909: W. H. Crosthwaite, 345 †
Nubra river and glacier, Karakoram, 640, 641, 643
Nushik La and Col, Himalayas, 108, 109
Nussbaumer, T., Ueber die Verunreinigung von Seen durch Einleitung städtischer Abwässer, 343 †
Nyasaland—
Minerals of, Report: W. Dunstan, 453 §, 735 †
Photographs of Nyasaland Protectorate: C. MacI. Ritchie, 480 †
Tribes in neighbourhood of Fort Manning, Notes on: C. H. Stigand, 95 †
Nyika, In Grip of the: J. H. Patterson, 187 §, 466 †

O.

Oberhummer, A. v., Häufigkeitszahlen der Bewölkung, 613 †
Oceanographical Museum at Monaco, 339: Opening of, 558
Oceanography—
Currents—
Einfluss des verschiedenen spezifischen Gewichts von Salz- und Süsswasser auf die Strömungen, etc., 473 †
Frage der durch den Wind erzeugten Meeresstromungen: O. E. Schiötz, 349 †
Druckgradient im Meerwasser in seiner Abhangigkeit von Temperatur- und Salzverteilung: C. Forch, 738 †
Eaux marines par flotteurs totalement immergés, Mesure des densités: J. Thoulet et Chevallier, 738 †
Echinodermes provenant des campagnes du yacht *Princesse Alice*: R. Koehler, 216 †
Exploration internationale de l'Océan Atlantique et de la Mediterranée: S. Marini, 216 †
Forschungsreise S.M.S. *Planet*. IV. Band, Biologie: — Graf, 473 †
Norwegian fishery and marine investigations: J. Hjort, 179 §, 216 †
Ozeanographische Arbeiten S.M.S. *Planet* im Bismarck-Archipel, 1907.. 216 †, 442 §
School of Oceanography in University of Paris, 558

Oceanography—*continued.*
Scientific and biological researches in North Atlantic: R. N. Wolfenden, 216 †
Temperature oscillations in . . . ocean: E. M. Wedderburn, 618 †
Travaux de Commission A dans la période, 1902–1907, Rapport: J. Hjort, 216 †
Vorläufiger Bericht über eine oceanographische Forschungsreise: R. Lütgens, 216 †
Voyage of *Michael Sars*, 601
Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer *Valdivia*, 1898–1899: C. Chun, 216 †
Odorizzi, D., Dancalia italiana del Nord, 345 †
Offret, A., Oural au point de vue minier et métallurgique, 342 †
Ogilvie-Grant, W. R., remarks on "Naturalist's Travels on Congo-Zambezi Watershed," 145
Ohio—
Geographic Influences in Development of Ohio: F. Carney, 737 †
Wheat production, 44
Oil Palm, Economic Aspects of, 349 †
Okey, T.: *see* King, B.
Ollone, H. d', Chine Occidentale (Thibet, Mongolie), 607 †
Olsen, O. T., Fisherman's Nautical Almanac, etc., 474 †
Omar Khayyan, Pilgrimage to Tomb of: P. M. Sykes, 465 †
Omdurman, survey work in, 541
Omori, F., Note on Long-period Variations of Atmospheric Pressure, 614 †
Ontario—
Geological Survey, Reports: W. J. Wilson and W. H. Collins, 610 †
Oramar, Kurdistan, 374
Orange River Colony—
Aftermath of War: G. B. Beak, 735 †
Orange river, South-West Africa, Flora of district, 494
Ordnance Survey Maps of England and Wales, † 100, 220, 351, 475, 615, 740
Oregon—
Geology and Water Resources of Harney Basin Region: G. A. Waring, 470 †
Orel, E. Ritter von, The stereo-autograph, 338
Orient—
Orient, Der, eine Länderkunde: E. Banse, 739 †
Ormuz—
Portuguese inscription in ruins at Ormus: F. Jardim, 449
Ornithologist, Camps and Cruises of an: F. M. Chapman, 212 †, 330 §
Ostenfeld, C. H., *Biddulphia sinensis* in North Sea Waters, 738 †
Oswald, F., Tektonische Uebersichtskarte Armeniens, 352 †
Otago—
Geology of Queensland Subdivision, Western Otago: J. Park, 214 †
Ouston, T. G., Nineteen Days in Corsica, 607 †
Outerbridge, A. E., Mineral Wealth of Islands of Newfoundland and Jamaica, 611 †
Outes, F. F., and others, Estudio de las supuestas "escorias" y "tierras cocidas" de la serie pampeana de la República Argentina, 611 †
Ovamboland, flora of, 484
Overweg's Grave at Bornu, Finding of: W. P. Hewby, 450
Owen, L. A., Floods in Great Interior Valley of North America, 56 *
Owens, J. S., remarks on "Sand-dunes of Libyan Desert," 398
Oxford School of Geography, Lectures, etc., 601; progress of, 315, 316
Øyen, P. A., Kvartær-studier i den sydøstlige del af vort land, 90 †

P.

Pacific—
Depth and marine deposits of Pacific J. Murray and G. W. Lee, 738 †
Great Pacific Coast: C. R. Enock, 191 §, 469 †
Maps: Meteorological Charts of North and South Pacific (U.S. Weather Bureau), † 103, 223, 355, 479, 744, Pilot Charts of North and South Pacific (U.S. Hydrographic Office), † 103, 223, 355, 479, 619
Salzgehaltbestimmungen aus dem südwestlichen Stillen Ozean: W. Brennecke, 738 †
Soundings by survey ship *Planet* in Western Pacific, 82
Pacific islands—
Wanderings among South Sea Savages. H. W. Walker, 191 §
Padua, Story of: C. Foligno, 732 †
Palan Kuh, Central Asia, 398
Palermo, A., Terra sensibile e cosciente, 218 †
Palestine—
Descriptio terræ sanctæ et itineris ejus Hierosolymitani: L. de Suchen, 219 †
Palmer, A. S.: *see* Taylor, T.
Palmer, H., Pioneer Reconnaissance in Northern Selkirks, 96 †
Palmyra, Syria, 13
Pamir—
Maps: Uebersicht über die Pamir expedition, 1909: A. v. Schultz, 616 †
Panama—
Nel Darien e nell' Ecuador: E. Festa, 213 †, 327 §
Tratado entre las Repúblicas de Columbia y de Panamá: E. Cortes et C. C. Arosemena, 213 †
Panay, Isla de—
Descripción física, geológica y minera

en bosquejo de la Isla de Panay: E. Abella y Casariego, 218 †
Pandeme, Liberia, 286
Papua: see New Guinea
Paquet, A., Südsibirien und die Nordwestmongolei, 344 †
Para—
Explorations dans le nord de l'état de Para: A. Ducke, 611 †
Paraguay river, 517
Parapara subdivision, South Island, New Zealand, 336
Park, J., Geology of Queensland Subdivision, Western Otago, 214 †
Parker, H., Ancient Ceylon, 209 †, 583 §
Parkinson, J., Yoruba Folk-lore, 95 †
Parr, A. A. C., remarks on "Notes on Determination of Position near the Poles," 311
Passarge, S., Verwitterung und Abtragung in den Steppen und Wüsten Algeriens, 344 †
Partsch, J., Des Aristotle's Buch 'Ueber das Steigen des Nil,' 95 †
Patagonia—
Maps: Andine Gebiet Patagoniens Zwischen 40° und 44° S.: P. Krüger, 353 †
Patagonischen Anden: P. Krüger, 737 †
Studien über West-Patagonien: H. Steffen, 612 †
Patterson, J. H., In Grip of the Nyika, 187 §, 466 †
Paul, A. W., remarks on "Journeys in Bhutan," 41
Peace river, North Canada, 708
Peach, B. N., and others, Geology of Seaboard of Mid-Argyll, etc., 463 †
Pearson, H., Diamond Fields of Brazil, 611 †
Pearson, H. D., Progress of Survey in Anglo-Egyptian Sudan, 532 *
Pearson, H. H. W., Percy Sladen Memorial Expedition in South-West Africa, 735 †; Travels of a Botanist in South-West Africa, 481 *
Peary, R. E., Honour to, 82; medal awarded by R.G.S., 193, 339; North Polar journey of, 200; Report by Committee of National Geographic Society on Expedition to North Pole, 82
Peisker, J., Ältere Sozial- und Wirtschaftverfassung der Alpenslawen, 341 †
Peixe, Rio, Exploração do, Commissão Geographica e Geologica do Estado de S. Paulo, 328 §
Pelkington, W., Co-ordinate geometry applied to land-surveying, 215 †
Pella, Namaqualand, 494
Pelliot, P., Mission en Asie central, 209 †, 594 §
Peña, J. M. S., Viajes par la Costa del Pacífico. De San Salvador á Costa Rica, 213 †
Penck, A., Morphologie der Wüsten, 613 †
Pendulationstheorie. Ueber Simrothe neue Begründung der: F. Nölke, 613 †
Pennsylvania—
Wheat production, 44
Perko, G. A., Geschichtlicher Rückblick auf die Innerkrainer Höhlen und eine kurze Beschreibung derselben, 341 †; Subterranean Rivers in Karst region, 601; Tropfstein- und Wasserhöhle "Dimnice" bei Markovsina in Istrien, 88 †
Perret, F. A., Vesuvius: Characteristics and Phenomena of Present Repose Period, 732 †
Perruchot, L., Sheep and their Products in France, 592 §
Persia—
Drainage of, 402
System for transliteration of Persian, Afghan, and Arabian words, 92 †
Through Persia from Gulf to Caspian: F. B. Bradley-Birt, 183 §
Peru—
Boundary between Peru and Bolivia, Treaty of 1909..597
Costa sur del Peru, Informe sobre la: V. F. Marsters, 737 †
Crescentic Dunes of Peru: A. E. Douglass, 213 †
El laudo argentino: A. Ballivian, 212 †
Maps: Endgiltige Linienführung der neuen Grenze zwischen Peru und Bolivien, 354 †; Uebersicht von W. Sievers' Reisen in Peru und Ecuador, 1909..354 †
Old and New Peru: M. R. Wright, 191 §, 213 †
Photographs of Bolivia and Peru: F. Adams, 479 †
Trip into Interior of Peru: A. M. Moss, 70 §
Petermann, A.—
Petermann-Denkmal in Gotha: H. Haack, 474 †
Petermann island, Antarctic, 337
Petroleum, Origin of: L. V. Dalton, 739 †
Pfeiffer, H., Zusammensetzung der Bevölkerung des Grossherzogtums Baden, etc., 89 †
Philip, A., Proposal for a Simplified Calendar, 472 †
Philipon, —, et — Rey, Relation du second voyage à la Cochinchine, du navire Henri, 343 †
Philippi, E., Shelf-ice of Antarctic, 725
Philippine islands—
Anthropogeographie und Wirtschaftsgeographie der Philippinen: H. Berkusky, 465 †
Country between Subig and Mount Pinatubo: W. D. Smith, 94 †
Exploración del territorio de Davao (Filipinas): J. Rajal y Larré, 219 †
Geological Reconnaissance from Infanta, Tayabas, to Tanay, Rizal: H. M. Ickis, 608 †

Philippine islands—*continued.*
Mineral Resources of Philippines: W. D. Smith, 465 †
Physiography of Philippine Islands. III. Western Masbate: H. G. Ferguson, 94 †
Philips' Comparative Series of Large School Maps, United States, 102 †
Phillimore, R. H., Surveys in Shan States and Mekong Basin, 721
Phillips, P. L., List of Geographical Atlases in Library of Congress, 430 §
Photographic Exposure Record and Diary, 1910, Wellcome's, 614 †
Photographs—
Alps. Vue des Alpes avec mer de brouillards prise du Chasseron: A. Vautier-Dufour, 104 †
America, South: P. H. Fawcett, 480 †; ditto: F. G. Fisher, 619 †
Bahr-el-Ghazal: H. Channer, 104 †
Bolivia and Peru: F. Adams, 479 †
Chê-Chiang, China: H. R. Davies and, 228 †
Hunza and Chinese Turkestan: A. Shuttleworth, 224 †
Kenia, Mount: W. McG. Ross, 224 †
Mesopotamia: Sir W. Willcocks, 104 †
Nun Kun, Kashmir, Reproductions of Photographs taken on Bullock-Workman Expedition of 1906..356 †
Nyasaland Protectorate: C. MacI. Ritchie, 480 †
West Indies and South America: H. Bingham, 620 †
Piazza, G., Regione di Brava nel Benadir, 467 †
Piedmont glaciers, 271
Piquet, V., Civilisations de l'Afrique du Nord, 187 §, 211 †
Pisciccelli, M., Nel Paese dei Bango-Bango, 733 †
Pison river, Euphrates, 2
Pistor, H., Thüringischen Eisenbahnen, 731 †
Pittard, E., Découvertes prehistoriques dans la Dordogne, 607 †
Place-names—
Déformation de la transcription des noms géographiques du monde musulman, Quelques observations sur la: A. Galante, 350 †
Orbis latinus, oder Verzeichnis der wichtigsten lateinischen Orts- und Ländernamen: J. G. T. Graesse und F. Benedict, 217 †
Planet, Survey Ship, Soundings in Western Pacific, 82
Plate, River—
River Plate region forty-three years ago: D. Christison, 213 †
Playfair, A., The Garos, 733 †
Playne, S., and F. H. Gale, East Africa (British), its history, people, etc., 466 †
Pöch, R., Travels in Southern Kalahari and Studies of Bushman, 452
Poirier, E., Chile en 1908..471
Poland—
Maps: Befestigungen in Russisch-Polen: F. Kawkaski, 352 †
Polar Discoveries, Handbook of: A. W. Greely, 738 †
Polar Regions—
Currents, Polar, in Norwegian sea, 176, 177
Determination of Position near Poles, Notes on: A. R. Hinks, 299 *
Expeditions and Observations, 214 †
Exploration, Recent, 214 †
Observations, Polar, Graphical Method of Reducing, 301
Planimeter, Polar: how it is used and how it operates: F. J. Gray, 215 †
Polarwelt und ihre Nachbarländer: O. Nordenskjöld, 214 †
Praktische Verwertung der Polarländer und die Spitzbergenfrage: O. Nordenskjöld, 214 †
Pole—
How could an Explorer find the Pole? H. F. Reid, 613 †
Ponce, F. de P., Nuestros limites con los Estados Unidos del Norte, 611 †
Poonakha, Bhutan, 24
Porto Rico, Photographs: H. Bingham, 620 †
Portuguese colonies—
Maps: Atlas Colonial Português, 223 †
Potonié, H., Bildung der Moore, 739 †
Prindle, L. M., Fortymile quadrangle, 469 †
Prinz, G., Uebersicht der Reisewege in Mittelasien, 1909 (map), 352 †; Vergletscherung des nördlichen Teiles des zentralen Tian-schan-Gebirges, 93 †
Projections—
Kritik der flächentreuen Projektionen der ganzen Erde und einer Halbkugel: W. Behrmann, 472 †
Provence—
Tremblements de terre de Provence: P. Lemoine, 89 †
Ptolemy's Geography: Brief account of all Printed Editions to 1730: H. N. Stevens, 217 †, 590 §
Ptolemy's knowledge of West Africa, 79
Pumpelly, R., Explorations in Turkestan. Prehistoric Civilizations of Anau, 61 §
Pyrenees—
Pyrenees: H. Belloc, 582 §

Q.

Quarries, Vegetation of disused: S. Margerison, 717 §
Queensland—
Jardines' Expedition from Rockhampton to Cape York in 1864: Hon. A. Norton, 348 †
White colonization in, 673
Quelle, O., Diamant-Fundstellen in Deutsch-Südwestafrika nach dem gegenwärtigen Stande der Kenntnis (map), 353 †

Quevedo, S. A. L., Etnologia Argentina, 347 †; Tipos de Alfareria en la región Diaguito-Calchaqui, 347 †
Quick, H., American inland waterways, 470 †

R.

Radford, H. V., Explorations in district inhabited by Wood Bison, Northern Canada, 596
Radioactivity and Geology: J. Joly, 192 §
Rajal y Larré, J., Exploración del territorio de Davao (Filipinas), 219 †
Rajputana—
  Salt Deposits of Rajputana, Origin of: Sir T. H. Holland and W. A. K. Christie, 344 †
Rakaposhi peak, Himalayas, 106
Rákas-tál lake, Tibet, 323
Ramaer, J. C., Vorming von den Dellart en de terpen in Nederland, 731 †
Raman's drift, Orange river, 495
Rambonnet, F. L., De jongste opvaart der Mambèrâmo, 612 †
Ramsay, Sir W. M., and G. L. Bell, Thousand and One Churches, 465 †, [illegible] §
Rand, McNally & Co., Indexed County and Railroad Pocket-maps of United States, 743 †
Range, P., History of Diamond Fields of German South-West Africa, 197
Ransome, F. L., and others, Geology and Ore Deposits of Goldfield, Nevada, 736 †
Rappard, Captain v., Durch die Namib nach Lüderitzbucht, 346 †
Rasmussen, K., Project of a Danish Expedition to Central Eskimo, 295
Rassam, H., letter from, on Garden of Eden and Ur of the Chaldees, 459
Raveneau, L., Bibliographie Géographique Annuelle, 1908..474 †
Rawling, C. G., Expedition in Dutch New Guinea, 454
Rawson, H. E., Anticyclonic belt of Northern hemisphere, 613 †
Reck, H., Kainozoischen Vulkane Deutschlands und unsere Vulkantheorien, 342 †
Redcliff peninsula, Greenland, Ice-cap of, 271
Reddish Canal, Occurrence and distribution of some alien aquatic plants in: F. E. Weiss and H. Murray, 92 †
Reeves, E. A., remarks on "Notes on Determination of Position near the Poles," 308
Refraction—
  Nile Valley, Refraction across: B. F. E. Keeling, 99 †
  Terrestrial Refraction at Alexandria: C. Xydis, 79 §, 99 †
Reggio—
  Messina e Reggio nella Storia, 342 †
Reiber, J.: see Hemel, C. v.
Reichert, F., Expedition in Andes, 336
Reid, H. F., How could an Explorer find the Pole? 613 †. Observations of Glaciers, 99 †; Seismological Notes, 478 †
Reinhard, W., Entwickelung des Kartenbildes der Britischen Inseln bis auf Merkators Karte vom Jahre 1564.. 445 §, 463 †; Manuskriptkarte der Britischen Inseln aus dem 16. Jahrhundert, 92 †
Reinisch, R. (see *also* Zirkel, F.), Gesteine von der Bouvet-Insel, von Kerguelen, St. Paul und Neu Amsterdam, 348 †
Reisner, H., Staubecken im Odergebiete 731 †
Remo glacier, Karakoram, 652
Rensselaer, Kilian van, Van Rensselaer Bowier Manuscripts, being letters of, 1630-1643..212 †
Rensselaer, S. van, History of city of New York in seventeenth century, 212 †
Repelin, M. J., Italie et ses Legions Sismiques, 342 †
Resafe, Mesopotamia, 579
Reusch, H., Geologiske og geografiske bemerkninger om det landskap man ser ut over fra Holmenkollen ved Kristiania, 90 †; Nogen bemerkninger om indsjøers dannelse i Skiensvasdraget, 732 †; Sicilien; en geografiske skisse, 90 †
Reviews—
  Afghan scrap-book, Leaves from. E. and A. Thornton, 711
  Africa and Australia: J. B. Reynolds, 75
  Africa, In Wildest: P. MacQueen, 187
  Africa, Map of, by Treaty: Sir E. Hertslet, 325
  Africa, Portuguese West, Labour in: W. A. Cadbury, 588
  Africa, South, from Great Trek to Union: F. R. Cana, 326
  Africa, South, Ore Deposits of: J. P. Johnson, 188
  Africa, South (Romance of Empire Series): I. D. Colvin, 68
  Africa, South, Union of: Hon. R. H. Brand, 188
  Afrika, Ins Innerste: A. F. Herzog zu Mecklenberg, 437
  Afrikas Wildkammern als Forscher und Jäger: A. Berger, 586
  Afrique du Nord, Civilisations de: V. Picquet, 187
  Alaska, Handbook of: A. W. Greely, 69
  Albania, High: M. E. Durham, 322
  America, Central and South, Stanford's Compendium of Geography and Travel: A. H. Keane and Sir C. R. Markham, 69
  Anson's Voyage Round World 1740–1744: C. G. Cash, 192
  Antarctic. Meteorologishe Ergebnisse der Schwedischen Südpolar-Expedition. Stündliche Beobachtungen bei Snow Hill: G. Bodman, 440

Reviews—*continued.*
Argentino-Chilena, La Frontéra, 588
Asia. Oxford Geographies, vol. 4: F. D. Herbertson, 716
Atlantic, North, Scientific and Biological Researches in: R. N. Wolfenden, 442
Australian Meteorology, Discussion of, Solar Physics Committee: W. J. S. Lockyer, 70
Austria-Hungary: G. Drage, 179
Avebury and Neighbourhood, Guide to: R. H. Cox, 321
Baltic. Hydrographische Untersuchungen im nördlichen Teile der Ostsee, etc.: R. Willing, 180 §
Bernese Oberland: W. A. B. Coolidge, 181
Birmanie, En: Prince G. Sturdza, 66
Bosnia and Herzegovina: M. M. Holbach, 182
Britain's Sea Story: E. E. Speight, 181
British Columbia Coast Names: J. T. Walbran, 590
British Empire. Book VII. A Scientific Geography: E. W. Heaton, 75
British Isles, Geography of: A. M. Davies, 75
British Isles. Vol. 7, Oxford Geographies: F. D. Herbertson, 716
British Isles. Practical and Economic Geography: C. A. Wood, 75
British Isles, Systematic Geography of: G. W. Webb, 76
British Mountain Climbs: G. D. Abraham, 181
By road and River: E. M. Wilmot-Buxton, 76
Cambridge County Geographies. Edited by F. H. H. Guillemard, 181, 322
Canada, Empire of the North: A. Laut, 590
Cap de Bonne-Espérance au XVII^e Siècle: H. Dehérain, 68
Ceylon, Ancient: H. Parker, 583
Cheshire. Cambridge County Geographies: T. A. Coward, 322
Chile, Acht- Lehr- und Wander-jahre in: O. Bürger, 439
Chile: Handbook by International Bureau of American Republics, 69
Chile, Republica de, Primera Memoria del Director de la Oficina de Mensura de Tierras, 440
China, Face of: E. G. Kemp, 188
China, Great Wall of: W. E. Geil, 584
China: its Marvel and Mystery, 184
Coast, Erosion of the, and its Prevention: F. W. S. Stanton, 582
Congo Belge, Loi sur le Gouvernement du, 327
Cooch Behar, the Duars, and Assam, Thirty-Seven Years of Big Game Shooting in: Maharajah of Cooch Behar, 184
Crete, the Forerunner of Greece: C. H. and H. Hawes, 434
Reviews—*continued.*
Darien e nell' Ecuador, Nel: E. Festa, 327
Egypt and Sûdân, Guide to: Macmillan & Co., 588
Egyptian Deserts, Travels in Upper: A. E. P. Weigall, 68
Ethiopie Mission en: J. Duchesne-Fournet et H. Froidevaux, 436
Europe, Systematic Geography of: G. W. Webb, 716
Far East, Scamper through: H. H. Austin, 184
Fes, Journal of our Mission to: Count Gleichen, 588
France, Régions et Pays de: J. Fèvre et H. Hauser, 582
Frontier Mountain Warfare, Some Principles of: W. D. Bird, 192
Fryer's East India and Persia: W. Crooke, 184
Geography, Elementary, Vols. 1 to 3. F. D. Herbertson, 74
Geography, Modern, for Irish Intermediate Schools: J. H. Cousins, 75
Geography, New Outlook, Book I. How people live: W. C. Brown and C. H. Johnson, 75
Geography, Physical, Manual of: F. V. Emerson, 716
Geography, Practical: J. F. Unstead, 74; Ditto: J. and W. Miller, 716
Geography, Practical Exercises in Geography: B. C. Wallis, 75
Gloucestershire. Cambridge County Geographies: H. A. Evans, 181
Great and Greater Britain: J. E. Barker, 181
Grizzly Bear: W. H. Wright, 190
Hudson, Picturesque: C. Johnson, 330
Hunterian Museum in University of Glasgow, Catalogue of Manuscripts in Library of: J. Young and P. H. Aitken, 715
Igneous Rocks, Natural History of: A. Harker, 192
India, Gates of: Sir T. Holdich, 708
India, German Staff Officer in: Count H. von Königsmarck, 184
India in the Empire, Place of, Lord Curzon, 184
India, My Thirty Years in: Sir E. C. Cox, 184
India, Overland Trek from: E. F. Benn, 183
Indo-Chinois, Regions Moï du sud: H. Maitre, 66
Isafold, Reisebilder aus Island: I. von Grumbkow, 321
Island, Wüstenritte und Vulkanbesteigungen auf: C. Küchler, 321
Italy, Northern, and Milan, Lakes of, Grieben's Guide Books, 182
Italy To-day: B. King and T. Okey, 182
Japan, Ancient Tales and Folklore of: R. G. Smith, 66

Reviews—*continued.*
Japonais, L'Empire: J. Dautremer, 586
Java, Ile de, sous la domination française: O. J. A. Collet, 586
Kapland insonderheit Das Reich der Kapflora das Waldgebiet und die Karroo, 711
Land of Golden Trade: J. Lang, 587
Lawes, W. G. of Savage Island and New Guinea: J. King, 192
London Library, Subject-Index of: C. T. H. Wright, 714
Louise, Lake, Region, Guide-book to: W. D. Wilcox, 329
Magallanes, Territorio de, Censo Jeneral del: L. N. Avaria, 589
Malay Archipelago, Through: E. Bichings, 586
Malaya, Adventures of John Smith in: A. Hale, 66
Man, Isle of: A. Herbert, 181
Man, Races of, their Distribution: A. C. Haddon, 192
Mexico: C. R. Enock, 188
Mexico, Wonderland of South: W. E. Carson, 590
Middlesex, Highways and Byways in: W. Jerrold, 181
Military Geography, Introduction to: E. S. May, 717
Mosquito or Man? Sir R. Boyce, 445
Mulai Hafid at Fez, With: L. Harris, 187
Neuseeland: M. F. Blasneck, 191
New North: A. D. Cameron, 329
New Spain, True History of Conquest of. Vol. 1: Bernal Diaz. Translated by A. P. Maudslay, 68
New Zealand, Dominion of: Sir A. P. Douglas, 71
North Sea, Fishery and Hydrographical Investigation in, Second and Fourth Reports, 433
Norwegian Fishery and Marine Investigation, Report, 179
Nun Kun, Peaks and Glaciers of: F. B. and W. H. Workman, 435
Nyika, In Grip of the: J. H. Patterson, 187
Ornithologist, Camps and Cruises of an: F. M. Chapman, 330
Pacific Coast, Great: C. R. Enock, 191
Papua, Across: K. Mackay, 191
Persia from Gulf to Caspian, Through: F. B. Bradley-Birt, 183
Peru, Old and New: M. R. Wright, 191
Peru, Trip interior of: A. M. Moss, 70
Pflanzenbarren der Afrikanischen Flüsse: O. Deuerling, 184
Ptolemy's Geography: H. N. Stevens, 590
Pyrenees: H. Belloc, 582
Radioactivity and Geology: J. Joly, 192
Rhodesia, Southern: P. F. Hone, 188
Roman Campagna, Wanderings in: R. Lanciani, 582
Reviews—*continued.*
Russische Polarfahrt der Sarja, 1900–1902 aus den hinterlassenen Tagebüchern von Baron Eduard von Toll, 71
Sahara, Gateway to: C. W. Furlong, 187
Sahara Soudanais: R. Chudeau, 66
Sailing Ships: E. K. Chatterton, 192
Santal Parganas, Folk-lore of: C. H. Bompas, 184
Sao Paulo, Commissao Geographica e Geologica do Estado de Exploracao do Rio Tieté, etc., 328
Scholar's Book of Travel Four parts, 715
School Journeys, Typical. G. G. Lewis, 716
Scientific Geography. Book VI. Asia: E. W. Heaton, 76
Shaler, N. S., Autobiography of, 192
Sikhim and Bhutan: J. C. White, 182
South Sea Savages, Wanderings among: H. W. Walker, 191
Sport and Travel Papers: H. Melladew, 192
Stanley, Sir H. M., Autobiography of, 72
Sumatra, Auf neuen Wegen durch M. Moszkowski, 585
Switzerland of the Swiss: F. Webb, 582
Thames, Historic: H. Belloc, 322
Thousand and One Churches: Sir W. M. Ramsay and G. L. Bell, 583
Tibet. Dans les Marches Tibétaines: J. Bacot, 586
Tibet, Three Years in: Shramana Ekai Kawaguchi, 324
Touarag du Sud-Est; L'Air: C. Jean, 186
Trans-Himalaya: S. Hedin, 322
Turkestan, Travel and Sport in: J. N. P. Wood, 586
Turkey, Military Consul in: A. F. Townshend, 322
Unknown Land, In an: E. Robinson, 330
Venezuela and Colombia, Journal of Expedition across. H. Bingham, 191
Victoria, Lake, to Khartoum, with Rifle and Camera: F. A. Dickinson, 437
Westmoreland. Cambridge County Geographies: J. E. Marr, 181
Wilson, Sir C., Life of: Sir C. Watson, 443
Words and Places: T. Taylor and A. S. Palmer, 191
World, General Geography of: H. E. Evans, 75
World, Physical and Economic Geography of: C. A. Wood, 716
Yucatan, Record of Travel in: C. Arnold and F. J. Frost, 189
Yukon Territory (Government Printing Bureau), 589
Yunnan, Across: A. Little, 710

Revollo, A., Geografía del Departamento de Cochrancalla, 737 †
Reynolds, J. B., Africa and Australia, 15 §; Elementary Regional Geography. Ireland and Great Britain in outline, 739 †; Map Reading and Imagination, 100 †
Rezső, H., Staatsrechtliche Karte des Ungarischen Reiches, 476 †
Rgyong La, Karakoram, 632
Rhine—
Cultural Influences in Rhine Valley, 194
Rhodesia—
Northern: Fauna and Flora, 133; Karroo System in, and its relation to General Geology: A. J. C. Molyneux, 95 †
Railway construction in, 394
Southern: Rainfall of, C. E. and F. E. B. Tripp, 95 †: Southern Rhodesia: P. F. Hone, 188 §, 211 †
Rhone—
Navigation du Rhône et le projet de canal latéral: F. Frécon, 77 §, 89 †
Ricardo Franco hills, Bolivia, 525
Rice, H., River Uaupés, 682 *
Richardson, L., On River Development in Mid-South Wales, 464 †; Some Glacial Features at Aberedw in Wye Valley, 464 †
Richings, E., Through Malay Archipelago, 586 §
Rietfontein, South-West Africa, 493
Riff—
Région des Guelaya (Rif): M. Becerra, 467 †
Riggs, T., Marking the Alaskan Boundary, 96 †
Ripley, W. Z., European population of United States, 97 †
Ritchie, C. MacI., Photographs of Nyasaland Protectorate, 480 †
Rivers—
Concentration *versus* Transportation: G. B. Shattuck, 739 †
Erosion of Rivers, Baer's law of, M. J. Brunhes' researches on, 727
Formation of a river flat, 202
Robinson, E. C., In an unknown land, 212 †, 330 §
Robinson, E. Van Dyke, Economic Geography, 349 †; Wealth of Minnesota, 470 †
Robinson, H. E. C., "Lady Northcote" Atlas of Australia, 354 †; Map of New South Wales, showing Shires and Municipalities, 354 †
Robinson, T. B., remarks on "Geographical Factors that control Development of Australia," 680
Robson, J., Account of six years' residence in Hudson's Bay, 219 †
Roche, —, Au pays des Pahouins; Du Gabon au Cameroun, 94 †
Rochefort-sur-Mer, ses rades et son port: Vice-amiral Bugard, 341 †
Rocks—
Study of Rocks, Introduction to: L. Fletcher, 99 †
Roda island—
Ile de Rodah: Abbate Pacha, 345 †
Rodger, Sir J., Gold Coast of To-day, 467 †
Rogers, A. W., Note on a journey to Knysna, 609 †
Rogers Pass, Structures in vicinity of: E. M. Burwash, 93 †
Roggeveen, J., Dagverhaal der Ontdekkings Reis van, 219 †
Röm, Die Insel: E. Moritz, 342 †
Roman Campagna, Wanderings in.: R. Lanciani, 462 †, 582 §
Rome—
Wanderings in Roman Campagna: R. Lanciani, 462 †
Romer, E. von, Morphometrische Studien über die Ost Karpatischen Gebirgsformen, 720 §
Rosen, F., Charakterpflanzen des abessinischen Hochlandes, 609 †
Ross, W. McG., Photographs of Mount Kenia, 224 †
Rothaug, J. G., Geographischer Volksschul-Atlas, 355 †; Karte der österreichischen Alpenländer, 350 †
Rouchon, U., Recherches sur les inondations de la Loire supérieure, etc., 730 †
Rouffaer, G. P., De drie opvaarten der Mambèràmo, 612 †; Een bezoek aan de Topographische Inrichting te Batavia, 343 †
Rousiers, P. de, Grands ports de France, leur rôle économique, 462 †
Royal Geographical Society—
Christmas Lectures, 206
Lectures, 340
Library and Map Collection, List of older works added in 1909.. 218
Medal awarded to R. E. Peary, 193
Medals and Awards for 1910.. 591
Meetings, Session 1909–1910.. 85, 87, 206, 339, 460, 605, 729
Research Department Meetings, 86, 206, 339, 460, 729
Rühl, A., Geomorphologische Studien aus Catalonien, 732 †
Rumania—
Roumanie, 1866–1906.. 90 †
Runge, H., Schriftverzeichnis von Rudolf Credner, 217 †
Runö—
Insel Runö und ihre Bewohner: C. Krah, 342 †
Russia—
Maps: Befestigungen in Russisch-Polen: F. Kawkaski, 352 †
Ruwenzori—
Zoological Results on Ruwenzori Expedition, 1905–06: R. B. Woosnam, 468 †
Rykachef, M. M., Observations faites dans les différentes couches de l'atmosphère . . . à bord du bateau *Neptune*, 348 †

S.

Sachse, W., Wiederauffinden der Bouvet-Insel durch die deutsche Tiefsee-Expedition, 348 †
Sadd-blocks, Formation of, 185
Sahara—
Across Sahara from Tripoli to Bornu: H. Vischer, 735 †
Exploration au Sahara: E Cortier, 735 †
Exploration géologique et minéralogique de l'Eguéi: G. Garde, 96 †
Gateway to the Sahara: C. W. Furlong, 127 §, 211 †
Maps: Saharisch-Sudanische abflusslose Gebiet: H. Marquardson, 353 †
Observations astronomiques dans le Sahara algérien: J. Nieger, 96 †
Sables du Sahara Algérien: G. Cauvet, 96 †
Sahara Soudanais: R. Chudeau, 66 §
Surveys in Central Sahara by M. Villatte, 197
Touarag du Sud-Est; l'Aïr: C. Jean, 186 §
Voyage à travers le Sahara: C. de Leca, 735 †
Sainsbury, E. B., Calendar of court minutes, etc., of East India Company, 1640–1643 .. 607 †
St. Martin, V. de, et F. Shrader Atlas Universel de Géographie, 103 †
St. Paul—
Flora und Vegetation von St. Paul und Neu-Amsterdam: H. Schenck, 348 †
Gesteine von . . . St. Paul, etc.: R. Reinisch, 348 †
Sakais tribe, Sumatra, 585
Saleeby, N. M., History of Sulu, 94 †
Salesses, E., Carte démographique de la Guinée, 452 §, 609 †; Distribution of Population in French Guinea, 452
Salmon, P. R., Off Beaten Track in Syria, 608 †
Salton sea—
Evaporation, rate of, 83
Saltoro pass and valley, Himalayas, 64, 624–626, 630
Samec, M., Kenntnis der Lichtintensitäten in grossen Seehöhen, 739 †
Samoa—
Maps: Samoa-Insel Savaii: K. Wegner, 743 †
Sand, M. J.: *see* Madsen, V. H. O.
Sand-dunes (*see also* Dunes)—
Barchans or Desert Sand-dunes, letter from D. Comyn on, 605
Crescentic Dunes of Peru, 213 †
Distribution of, 248
Libyan Desert, Sand-dunes of: H. J. L. Beadnell, 379*
Sanders, C., Contributions to determination of geographical positions on west coast of Africa, 344 †
Sandmann, D., Studienreise in das tropische Brasilien, 97 †
S. Francisco, Rio—
Agro-Geologia do Valle do S. Francisco: H. F. Williams, 611 †
San Martin, Savanna country of, 664
Sanga river—
Basses vallées de l'Oubangui et de la Sanga: G. Bruel, 609 †
San Salvador—
Viajes por la Costa del Pacífico, De San Salvador á Costa Rica: J. M. S. Peña, 213 †
Santal Parganas, Folk-lore of: C. H. Bompas, 184 §, 343 †
Sao Paulo—
Exploração do Rio Tenté, Rios Feio e Aguapetry, Rio Peixe. Commissão Geographica e Geologica do Estado de S. Paulo, 328 §
Saposhnikoff, V. V., Journey in Altai Region, 195
Sapper, K., Bemerkungen über einige südländische Gletscher, 342 †; Neu-Mecklenburg, 213 †; Mecklenburg, 213 †; G. Friederici, und W. Wernicke, Aufnahmen auf der Gazelle-Halbinsel, Neu Pommern, 743 †
Saralegui y Medina, M de, Sr. D. C. F. Duro (Biography), 474 †
Sarawak—
History of Sarawak under its two white Rajahs: S. Baring-Gould and C. A. Bampfylde, 344 †
Sarawan—
Geology of Sarawan, Jhalawan, etc., Report on. E. W. Vredenburg, 593 §, 607 †
Sargent, R. H., Monarchs of Alaska, 96 †
Sarre, F., Reise in Mesopotamien, 465 †
Sasir pass, Karakoram, 650
Sasamato, J., Depression of land along line of Railway Hyuga, 94 †
Saskatchewan—
Exploration between Saskatchewan and Churchill Rivers, 1908: J. P. Crean, 470 †
Maps: Southern part of Province of Saskatchewan (Dept. of Public Works), 353 †
Wheat production, 54
Sat Dagh, Kurdistan, 371, 374
Sawicki, L. Ritter von, Beitrag zum geographischen Zyklus im Karst, 342, Nordappenin und die Westkarpathen, eine morphologische Parallele, 99 †
Saxony—
Waldhufensiedelungen in Sachsen: B. Bruhns, 731 †
Scenes from every land: G. H Grosvenor, 475 †
Schenck, H., Beiträge zur Kenntnis der Vegetation der Canarischen Inseln, 344 †; Ueber Flora und Vegetation von St. Paul und Neu-Amsterdam, 348 †; Vergleichende Darstellung der Pflanzengeographie der subantarktischen Inseln, 348 †

Scherer, J., Liberianische Küstenfahrten und Urwaldwanderungen, 610 †
Schew, E., Morphologie der Schwäbisch-Fränkischen Stufenlandschaft, 77 §, 342 †
Scheuchzer, J. J., Nova Helvetiæ tabula geographica, 1712..219 †
Schiaparelli, E., Geografia dell' Africa orientale secondo le indicazioni dei monumenti egiziani, 609 †
Schiötz, O. E., Zur Frage der durch den Wind erzeugten Meeresstromungen, 349 †
Schlagintweit, H. von, Reisen in Indien und Hochasien, 219 †
Schlobach, —, und M. Moisel, Karte der deutsch-portugiesischen Grenze Zwischen dem oberen Rowuma und dem Njassa, 477 †
Schmauss, A., Die Obere Inversion, 349 †
Schneider, K., Jahrbuch über die deutschen Kolonien, 218 †
Schokalsky, J. de, Niveau des lacs de l'Asie Centrale russe, 608 †
Scholars' book of travel, 475 †, 715 §
School Economic Atlas: J. G. Bartholomew and L. W. Lyde, 618 †
School journeys, Typical: G. G. Lewis, 475 †, 716 §
Schorkopf, —, Forstwissenschaftliche Expedition, 1908–09..95 †
Schouteden, H., Catalogues raisonnés de la Faune Entomologique du Congo Belge, 94 †
Schrader, F.: *see* St. Martin, V. de
Schröter, C., Eine Exkursion nach den canarischen Inseln, 344 †
Schultz, A. v., Uebersicht über die Pamir-expedition, 1909 (map)..616 †
Schultze, A., Beobachtungen über die Fauna und Flora der Grashochländer Kameruns, 467 †
Schultze, L., Expedition in New Guinea, 337
Schulz, A., Siedlungen des Warnow-gebietes in Mecklenburg, 341 †, 447 §
Schulze, G., Beiträge zur Landes- und Siedlungskunde des Fichtelgebirges, 332 §, 341 †
Schuster, K., Petrographische Ergebnisse der brasilianischen Expedition, 1901.. 347 †
Schwab, M., Phéniciens . . . dans le bassin de Méditerranée, 732 †
Schwabe, K., Im deutschen Diamantenlande, 467 †
Schwarz, E. H. L., Discoveries of economic importance made by Albany pioneers, 96 †
Schwarz, E. H. S., Secular Earth-creep, 99 †
Schwendig, E., Beobachtungen der Temperatur und des Salzgehalts der Meeresoberfläche zwischen Sues und Sydney, 473 †
Sclater, P. L., remarks on "Naturalist's Travels on Congo-Zambesi Watershed," 145
Sclater, W., remarks on "Naturalist's Travels on Congo-Zambesi Watershed," 145
Seobel, A., Geographisches Handbook, 218 †
Scotland—
Climate in East of Scotland, Influence of Topographical Conditions upon: J. S. Begg, 463 †
Geological Survey of Scotland, Memoirs B. N. Peach and others, 463 †
Geological map of Scotland: Sir A. Geikie, 220 †
Highlands d'Ecosse, Dans les: M Demangeon, 463 †
Lakes of Scotland, Seiches in: G Chrystal, 208 †
Maps: Bartholomew's "Quarter-Inch-to-Mile" map of Scotland, 615 †
Scott, R. F., Government Grant to, 201; proposed South Polar Expedition, 83, remarks on "Notes on Determination of Position near the Poles," 305
Scott-Elliot, G. F., Migration of Man, 85 §, 216 †; Valley tracks and vegetation, 201
See, T. J. J., Past History of Earth as inferred from Mode of Formation of Solar System, 473 †
Seidel, H., Balsazar Hacquet als Karpathenforscher, 606 †; B. Hacquet's Reisen in der Hohen Tatra, 606 †
Seiner, F., Wirtschaftsgeographischen . . . Verhaltnisse des Caprivizipfels, 467 †
Seismology (*see also* Earthquakes)—
Earthquakes in Light of New Seismology: O. C. Carter, 99 †
Rätsel des 10. Juli 1907 in ihrem geophysikalischen Zusammenhange W. Krebs, 473 †
Seismological Notes: H. F. Reid, 473 †
Seistan—
Hippurite-bearing limestone in Seistan, Note on: E. W. Vredenburg, 608 †
Selkirks—
Pioneer Reconnaissance in Northern Selkirks: H. Palmer, 96 †
Semliki—
Measurement of Semliki Base: E. M. Jack, 345 †
Semple, E. C., Operation of Geographic Factors in History, 217 †
Senegal river—
Hydrographie du fleuve Sénégal: Captain Fromaget, 94 †
Servia—
Annexion de la Bosnie et la question Serbe: J. Cvijić, 88 †
Severn—
Lower Severn Valley: T. S. Ellis, 92 †
Sewell river, Kurdistan, 376
Seychelles—
History of Seychelles Islands anterior to 1810, Unpublished documents, etc.: A. A. Fauvel, 93 †

Shackleton, E. H., Heart of the Antarctic, 214 †
Shah Dagh, Caucasus, 195
Shaler, N. S., Autobiography of, 192 §
Shan States—
Surveys in Shan States and Mekong Basin: R. H. Phillimore, 721
Shannon Valley, Lower, Forests of Counties of: T. J. Westropp, 91 †
Shan-si, Explorations by R. Clark in, 595
Shattuck, G. B., Concentration *versus* Transportation, 739 †
Shella range, Angola, 506, 507
Shemsdinan Su, Kurdistan, 371
Sheppard, T., Papers and Records . . . Geology and Palæontology of North of England, 1902–1908 . . . 91 †
Sherrarat tribe, Arabia, 229, 237
Ships—
Sailing Ships: E. K. Chatterton, 192 §
Shuttleworth, A., Photographs of Hunza and Chinese Turkestan, 224 †
Shyok valley, Upper, Notes on Glaciers of, 647
Siachen glacier, Himalayas, 64, 630, 643–645, 655
Siam—
Mission archéologique . . . au Siam: E. Lunet de Lajonquière, 343 †
Royal Survey Department, 1906–07, General Report on Operations of, 465 †
Vegetationsbilder aus Siam: C. C. Hosseus, 608 †
Siberia—
Jesup North Pacific Expedition. Vol. 7, The Chukchee: W. Bogoras, 210 †
Lamas de Sibérie, Avec les: P. Labbé, 210 †
Maps: Siberian Railway, E. Stanford, 477 †
Südsibirien und die Nordwestmongolei: A. Paquet, 344 †
Temperatur ostsibirischer Flüsse und eines Polarsees daselbst: A. Woeikow, 465 †
Sibiriakoff, A., New route across Northern Urals, 194
Sicily—
Sicilien; en geografiske skisse: H. Reusch, 90 †
Siebenthal, C. E.: *see* Darton, N. H.
Siena ou Senoufo, Le peuple: M. Delafosse, 467 †
Sierra Leone—
Transformed Colony: Sierra Leone as it was and as it is: S. J. Alldridge, 735 †
Sievers, W., Uebersicht von Reisen in Peru und Ecuador, 1909 (map) . . 354 †
Sikkim—
Sikkim and Bhutan, Twenty-one years on North-Eastern Frontier, 1887–1908: J. C. White, 182 §, 210 †
Silesia—
Bevölkerung in der Provinz Schlesien: M. Groll, 731 †
Simpson, G. C., Bodman's 'Meteorologische Ergebnisse der Schwedischen Südpolar-Expedition,' 440 §
Simpson, W. J., Report on plague in Gold Coast in 1908 . . 95 †; Report on Sanitary Matters in various West African Colonies, 211 †
Simtoka fort, Bhutan, 23
Sinai—
Six Months in Northern Sinai: L. B. Weldon, 345 †
Sining, Great Wall of China at, 585
Ski—
Mountaineering on Ski: E. R. Clarke, 100 †
Skottsberg, C., R.G.S. award to, 591
Slack, C., remarks on "Journey in North-Western Arabia," 248
Slovenes—
Ältere Sozial- und Wirtschaftsverfassung der Alpenslawen: J. Peisker, 341 †
Smith, B., Some Recent Changes in Course of the Trent, 568 *
Smith, E. M., Study of Volcanic Topography, 737 †
Smith, R. G., Ancient Tales and Folklore of Japan, 66 §
Smith, S., New land maps of world, 472 †
Smith, W. D., Country between Subig and Mount Pinatubo, 94 †; Mineral Resources of Philippine Islands, 465 †
Snethlage, Miss, Expedition in Central Brazil, 335
Sollas, H. B. C., Suess' 'Face of the Earth' translated by, 473 †
Solomons, T. S., Surface Features of Northern Alaska, 96 †
Somaliland—
Regione di Brava nel Benadir: G. Piazza, 467 †
Seconda colonia italiana, Il Benadir: G. Coen, 610 †
Sona-ga-sa, Bhutan, 25
Sorre, M., Questions Forestières, 474 †
Sossus, German South-West Africa, 80
South Sea Savages, Wanderings among: H. W. Walker, 191 §, 214 †
Southern Ocean—
Pflanzengeographie der subantarktischen Inseln, Vergleichende Darstellung der: H. Schenck, 348 †
Sowers, D. C., Magnetic research in China, 722
Spain—
Maps: Mapa Topografica de España (Inst. Geo. y Estadistico), 101 †
Spanischen Provinzialgrenzen in römischer Zeit: F. Braun, 732 †
Speight, E. E., and R. M. Nance, Britain's Sea-Story, B.C. 55—A.D. 1805 . . 181 §, 217 †
Spethmann, H., Aufbau der Insel Island, 342 †; Beiträge zur Kenntnis des Vulkanismus am Mückensee auf Island, 342 †; Grundzüge der Oberflächengestaltung Cornwalls, 91 †; Küste der

Englishen Riviera, 91 †; Ueberblick über die Ergebnisse der v. Knebelschen Islandexpedition 1907..731 †
Spinden, H. J.: *see* Will, G. F.
Spitsbergen—
Geologi, Lidt om Spitsbergens: G. Holmsen, 613 †
Maps: Skisse des Gebietes zwischen Belsund und Eisfjord: G. Holmsen, 743 †
Polar current, 177
Relation des aventures arrivées à quatre matelots russes, etc.: P. L. LeRoy, 219 †
Spitsbergenekspeditionen 1907: G. Isachsen, 98 †
Sport and Travel Papers: H. Melladew, 192 §
Sprigade, P., Karte von Deutsch-Ostafrika, 478 †; und M. Moisel, Grosser deutscher Kolonialatlas, 222 †; Karte von Deutsch-Südwestafrika, 478 †; und G. Thomas, Landschaften um den Agu (map), 478 †
Springbok, Namaqualand, 492
Srepok river, Cambodia, 593
Staffordshire—
Geology of North Staffordshire Coalfields: W. Gibson, 208 †
Stalker, W., death of, 336
Stanford, E., Map of Siberian Railway, 477 †; New Map of Metropolitan Railways, etc., 476 †
Stanley, D., Autobiography of Sir H. M. Stanley, 72 §, 217 †
Stanley, G. H.: *see* Anderson, W.
Stanley, Sir H. M., Autobiography of: D. Stanley, 72 §, 217 †
Stanton, F. W. S., Erosion of the coast and its prevention, 472 †, 582 §
Stapf, O., remarks on "Travels of a Botanist in South-West Africa," 512
Steen, A. S., Einige Studien über die Bewolkung, 348 †
Steenstrup, K. J. V., Geologiske og antikvariske Iagttagelser i Julianehaab Distrikt, 612 †
Stefánsson, V., Northern Alaska in Winter, 469 †
Steffen, H., Studien über West-Patagonien, 612 †
Stein, A., Exploration géographique et archéologique en Asie centrale (1906–1908), 464 †; Geographische und archäologische Forschungsreisen in Zentralasien 1906–1908, 343 †; remarks on "Journey in North-Western Arabia," 247
Steinmetz, K., Von der Adria zum Schwarzen Drin, 462 †
Stephani, Captain von, Nigeria-Kamerun Boundary, 197
Stereo-autograph, New Cartographical Instrument, 338
Sterneck, R. v., Fortschritte der Flutwelle im Adriatischen Meere, 462 †
Stevens, H. N., Ptolemy's Geography; Brief account of all Printed Editions to 1730..217 †, 590 §
Stevens, J. C., Surface Water-Supply of Nebraska, 470 †
Stewart, B., Active service pocket-book, 739 †
Stewart islands—
Botanical survey of Stewart Islands, Report on: L. Cockayne, 612 †
Stigand, C. H., Notes on Tribes in neighbourhood of Fort Manning, Nyasaland, 95 †; To Abyssinia through an unknown land, 734 †
Stockholm—
Geological Congress, Eleventh International, 601
Strahan, A., remarks on: "Cambridgeshire rivers," 703; "Notes on Determination of Position near the Poles," 308, 310 †; "Sand-dunes of Libyan Desert," 392; "Some Recent Changes in Course of the Trent," 578
Struck, A., Makedonische Fahrten, 463 †
Struck, B., African Ideas on Subject of Earthquakes, 99 †
Stübel, A., Vesuv, Eine Vulkanologische Studie für Jedermann, 207 †
Sturdza, Prince G., En Birmanie, 66 †, 209 †
Suarez, P., remarks on "Explorations in Bolivia," 529
Subterranean fire—
Erdbrände und deren angeblicke geophysische Konsequenzen: S. Günther, 99 †
Sudan—
Anglo-Egyptian Sudan, Progress of Survey in: H. D. Pearson, 532 *
French: Aperçu géologique sur les régions situées à l'est et au nord-est du Tchad: G. Gardo, 94 †
Guide to Egypt and Sûdân (Macmillan & Co.), 466 †, 588 §
In torrid Sudan: H. L. Tangye, 734 †
Irrigation, 427
Maps: Uebersicht von K. Kumms Durchquerung von Afrika durch den Sudan, 353 †
Railway System of Anglo-Egyptian Sudan 333
Surveys in Sudan, 533
Suess, E., Antlitz der Erde, 215 †; Face of the Earth. Translated by H. B. Sollas, 473 †
Suez, Gulf of—
Origin of Nile Valley and Gulf of Suez: J. Ball, 596 §, 609 †
Sulimanie, Kurdistan, 376
Sulu, History of: N. M. Saleeby, 94 †
Sumatra—
Maps: Overzichtskaart van het eiland Sumatra (Top. Bureau Batavia), 352 †
Reisen in Ost- und Zentral-Sumatra: M. Moszkowski, 608 †
Wegen durch Sumatra, Auf neuen: M. Moszkowski, 465 †, 585 §

Surveying—
Co-ordinate geometry applied to land-surveying: W. Pelkington, 215 †
Schools, Surveying in: J. Deas and F. Mort, 100 †.
Treatise on Surveying: R. E. Middleton and others, 472 †
Sussex—
Maps: Contour Relief Model of greater part of Sussex: G. R. C. Feigerl, 740 †
Spirit of the Downs: A. Beckett, 732 †
Sutton, J. R., Preliminary note on Diurnal Variation of Level at Kimberley, 345 †
Svedmark, E., Jordskalf i Sverige, 1904–1906, 90 †
Swann, A. J., Fighting slave-hunters in Central Africa, 734 †
Sweden—
Climate of Sweden in Late Quaternary Period: G. Andersson. 90 †
Jordskalf i Sverige, 1904–1906: E. Svedmark, 90 †
Switzerland—
Beatus-Höhlen am Thunersee, Ueber die: A. Heim, 342 †
Eisgebirge des Schweizerlandes: G. S. Gruner, 218 †
Föhns, Aus langjährigen Aufzeichnungen des Schweizer Föhns: J. Maurer, 343 †
Maps: Nova Helvetiæ tabula geographica, 1712: J. J. Scheuchzer, 219†
Switzerland of the Swiss: F. Webb, 462 †, 582 §
Topographia Helvetiæ, Rhætiæ et Valesiæ: M. Merian, 219 †
Sykes, M., Kurdish Tribes of Ottoman Empire, 94 †
Sykes, P. M., Pilgrimage to Tomb of Omar Khayyan, 465 †
Syria—
Off Beaten Track in Syria: P. R. Salmon, 608 †
Syrische Fragmente: E. Banse, 608 †
Szakàll, Z., Ungarns westliche Grenze im Jahre 1254..342 †

T.

Tachibana, Z., expedition to Chinese Turkestan and Mongolia, 448
Tahiti—
Monument to Bougainville at, 200
Talbot, M. G., Survey work in Sudan, 534
Ta-lo monastery, Bhutan, 24
Tang-chhu, Bhutan, 25
Tangye, H. L., In torrid Sudan, 734 †
Tarim river, changes in course, 408
Tarr, R. S., Some phenomena of glacier margins in Yakutat Bay region, 346 †; Yakutat Bay Region, Alaska. Physiography and Glacial Geology, 610 †
Tashi-bup-tso, Lake, Tibet, 595
Tashi-cho-jong, Bhutan, 23, 25, 28
Tasmania—
Resources and Future: Hon. J. McCall, 737 †
Taverner, Sir J., remarks on "Geographical Factors that control Development of Australia," 679
Taylor, T., and A. S. Palmer, Words and Places, 191 §
Taylor, W. E., remarks on "Sand-dunes of Libyan Desert," 393
Taylor's A. B. C. Railway map of India, 741 †
Taxo-jong, Bhutan, 23
Tehuantepec—
Geologia y Climatologia del Istmo de Tehuantepec, Breves apuntes sobre E. M. Castellanos, 346 †
Teima, oasis of, Arabia, 238
Teisserenc de Bort, L., Lois de distribution de la température avec la hauteur aux diverses latitudes, etc., 348 †
Teleki, Comte P., Connaissance et Représentation Cartographique de Fermose jusqu'à la fin du XVII^e Siècle, 93 †
Temperature: *see* Meteorology
Templeton, R. S., Survey Department, Ceylon, Report for 1908..93 †
Teneriffe—
Volcanic Eruption of 1909: J. S. Flett, 59
Teram Kangri, Karakoram, 65, 632
Termite and Driver Ants, Northern Rhodesia, 139
Terrestrial magnetism—
Magnetic Survey Yacht *Carnegie* and her Work, 216 †
Thalbitzer, W., Ethnological description of Amdrup collection from East Greenland, etc., 98 †
Thames—
Historic Thames: H. Belloc, 822 §, 464 †
Maps: Basin of Thames: W. & A. K. Johnston, 351 †
Theal, G. McCall, History of South Africa since September, 1795..735 †
Thessaly—
Östlichen Thessalien, Aus dem F. Mielert, 342 †
Thomas, A. E., Mineral Industry of Egypt, 345 †
Thompson, D. W., Fourth report on fishery and hydrographical investigations in North sea and adjacent waters, 433 §, 473 †
Thompson, H. N., Gold Coast. Report on Forests, 610 †
Thomson, B.: *see* Woodward, H. B.
Thornton, E. and A., Leaves from an Afghan Scrap-book, 711 §, 733 †
Thoulet, J., et Chevallier, Mesure des densités d'eaux marines par flotteurs totulement immergés, 738 †
Thousand and One Churches: Sir W. M. Ramsay and G. L. Bell, 465 †, 583 §
Thüringen—
Einfluss der Sommerfrischen auf

Thüringen—*continued.*
Volksdicte und Verkehr im . . . Thüringer Waldes: E. Fränzel, 731 †
Eisenbahnen, Thüringischen: H. Pistor, 731 †
Temperaturveränderlichkeit im Thüringer Wald, Einfluss der orographischen Lage auf die: G. Stephan, 731 †
Thurston, E., and K. Rangachari, Castes and tribes of Southern India, 733 †
Tian-shan—
Explorations in Tian Shan range by P. Gröber, 721
Vergletscherung der nördlichen Teiles des zentralen Tian-schan-Gebirges: G. Prinz, 93 †
Tibet—
Marches Tibétaines, Dans les: J. Bacot, 464 †, 586 §
Nain Singh's Work in, 595
Three Years in Tibet: Shramana Ekai Kawaguchi, 324 §
Trans-Himalaya: Discoveries and adventures in Tibet: S. Hedin, 322 §, 464 †
Travels in China-Tibetan Frontier; J. Bacot, 595
Tides—
Causes and representation: R. A. Harris, 99 †
Theorie der Entstehung der Tiden: A. Müller, 100 †
Tieté, Rio, Exploracão do, Commissão Geographica e Geologica do Estado de S. Paulo, 328 §
Tigris—
Country east of, 357
Delta and course, 3, 9
Time-indicating Cylinder: J. W. Westwell, 618 †
Tipperary—
Mitchelstown caves: C. A. Hill and others, 209 †
Tizard, T. H., remarks on "Sand-dunes of Libyan Desert," 393
Toepfer, —, Eisenbahnbauten im russisch-japanisch-chinesischen Grenzgebiet Ostasiens (map), 616 †
Togo—
Maps: Landschaften um den Agu: P. Sprigade und G. Thomas, 478 †
Toll, Baron von, Russischen Polarfahrt der Sarja 1900–1902 aus den hinterlassenen Tagebüchern von, 71 §
Tolmatschof, I. P., Expédition de Khanga de la Société Russe de geographie, 94 †
Topley, W., Geology of Weald, 219 †
Torii, R., A travel to Sira-muren and Khingan Mountains, 93 †
Tornau, F., Goldvorkommen Deutsch-Ostafrikas, 610 †
Tournay-Detillieux, J., Loi sur le gouvernement du Congo Belge, 327 §, 466 †
Townley, S. D., Shifting of Earth's Axis, 472 †
Towns—
Problème de la formation des villes: E. Clouzot, 474 †
Townshend, A. F., A military consul in Turkey, 210 †, 322 §
Trade routes—
Deutschen Dampferwege vom Kap der Guten Hoffnung nach Adelaide und Melbourne, etc., 474 †
Transvaal—
Geological Survey, Report for 1908.. 735 †
Meteorology in Transvaal: R. T. A. Innes, 468 †
Temperatures, Sea-level: R. T. A. Innes, 468 †
Travel, Scholars' book of, 475 †
Travellers' Tales: J. S. Keltie, 475 †
Trees—
Weather Cycles in Growth of Big Trees: A. E. Douglass, 335 §, 611 †
Trenk, —, Search for "Bushmen's Paradise," South-West Africa, 80
Trent—
Course of the Trent, Some Recent Changes in: B. Smith, 568 *
Life History of River Trent: A. M. McAldowie, 92 †
Trieste, climate of, 447
Triple Cornice peak, Himalayas, 110
Tripoli—
Gateway to Sahara: C. W. Furlong, 187 §, 211 †
Tripolitaine: Vicomte H. M. de Mathuisieulx, 468 †
Tripp, C. E., and F. E. B. Tripp, Rainfall of Southern Rhodesia, 95 †
Trotter, S., Atlantic Forest Region of North America, 611 †
Trotter, Sir H., remarks on "Journeys in Kurdistan," 378
Truffot, M., Note sur les irrigations . . . de la vallée Mékong au Cambodge, 93 †
Tsangpu river, Tibet, 397
Tschepe, P. A., Chinesische Holland in Mittelchina, 343 †
Tunis—
Maps: Carte de la Tunisie (Service Géo. de l'Armée), 353 †, 618 †
Routes de Tunisie, Sur les: B. Chantre, 736 †
Tun-Kwang, Collection of manuscripts at, 594
Turkestan—
Aeolian Action in Chinese Turkestan, 403
Explorations in Turkestan: B. Pumpelly, 61 §
Japanese expedition to Chinese Turkestan and Mongolia, 448
Mission Pelliot en Asie centrale, 209 †, 594 §
Orographie . . . et l'Administration du Turkestan Oriental: H. Bourgeois, 93 †
Photographs of Hunza and Chinese Turkestan: A. Shuttleworth, 224 †

Turkestan—*continued.*
Travel and Sport in Turkestan: J. N. P. Wood, 464 †, 586 §
Turkey—
Kurdish Tribes of the Ottoman Empire: M. Sykes, 94 †
Military Consul in Turkey: A. F. Townshend, 210 †, 322 §
Turner, E. P., Report on Botanical Examination of Higher Waimarino District, 737 †

U.

Uaupés River: H. Rice, 682 *
Ubai well, Arabia, 242
Ubangi river—
Basses vallées de l'Oubangui et de la Sanga: G. Bruel, 609 †
Uganda—
Botanical and Scientific Department, Report on (Colonial Reports), 736 †
Forests of Uganda: M. T. Dawe, 736 †
Maps: Uganda-Congo Commission, 1906–1908 (G.S.G.S.), 222 †
Report for 1907–08 (Colonial Reports), 96 †
Victoria, Lake, to Khartoum: F. A. Dickinson, 437 §, 468 †
Uhlig, V., Ueber die Tektonik der Karpathen, 606 †
Ule, W., Darwin's Bedeutung in der Geographie, 217 †
Unilla river, Amazonia, 686, 688
United Kingdom—
Battle of land and sea on Lancashire, Cheshire, and North Wales coasts: W. Ashton, 782 †
British Freshwater Phytoplankton: W. and G. S. West, 463 †
British Isles. Practical and Economic Geography: C. A. Wood, 75 §
British Mountain Climbs: G. D. Abraham, 181 §
By Road and River: E. M. W. Buxton, 76 §, 208 †
Canals and Waterways, Royal Commission on, Report, 565
Coast, Erosion of: F. W. S. Stanton, 472 †, 582 §
Denehole and other Chalk Excavations: J. W. Hayes, 76 §, 91 †
Elementary Geography. Vol. 2, In and about our own Islands: F. D. Herbertson, 74 §, 208 †; Ditto. Vol. 7, British Isles: F. D. Herbertson, 463 †, 716 §
Geography of British Isles: A. M. Davies, 75 §, 91 †
Geological Survey of Great Britain, etc., Summary of Progress, 91 †
Handbook for Travellers. Great Britain: K. Baedeker, 732 †
Kartenbildes der Britishen Inseln bis auf Merkators Karte vom 1564: W. Reinhard, 445 §, 463 †
United Kingdom—*continued.*
Manuskriptkarte der Britischen Inseln aus dem 16. Jahrhundert: W. Reinhard, 92 †
Maps: Reduced survey map of British Isles: J. Bartholomew & Co., 740 †
Rainfall of British Isles. H. R. Mill, 92 †
Roads to the North: J. Fairgrieve, 91 †
Systematic Geography of British Isles: G. W. Webb, 76 §
United States—
Coast and Geodetic Survey, Results of Magnetic Observations made by: R. L. Faris, 347 †; Ditto: D. L. Hazard, 97 †, 736 §
Economic Geology, Contributions to: M. R. Campbell and others, 347 †
European population of United States: W. Z. Ripley, 97 †
Geodesy. Figure of Earth and Isostasy from Measurement in United States: J. F. Hayford, 347 †
Geography in United States, Present Trend of: R. H. Whitbeck, 419 *
Highest Point in Each State, 736 †
Industrial Districts, 1905, Manufactures and Population, 212 †
Maps: Indexed county and railroad pocket maps: Rand, McNally & Co., 743 †; Kohlenfelder der Vereinigten Staaten: M. R. Campbell, 222 †; Philips' Comparative Series of Large School Maps, 102 †
Mineral Resources, Papers on Conservation of, 347 †
Our Pacific North-West: N. H. Darton 212 †
Population, Capacity of United States for: A. P. Brigham, 470 †
Population Growth from First Census to Twelfth, 470 †
Railway Traffic, Characteristics of American: E. R. Johnson, 737 †
Through Afro-America: W. Archer, 736 †
Volcanic Topography, Study of E. M. Smith, 737 †
Waterways, American inland: H. Quick, 470 †
Wheat production, 43
When our Country is Fifty Years Older: R. Zon, 611 †
United States South Polar Expedition, Organization of, 337
Unstead, J. F., Practical Geography. Part II. 74 §
Ur of the Chaldees, letter from H. Rassam on Site of, 459
Urals—
Géologiques Recherches et pétrographiques sur l'Oural du Nord: L. Duparc and others, 342 †, 462 †
Oural au point de vue minier et métallurgique: A. Offret, 342 †
Route across Northern Urals: A. Sibiriakoff, 194

V.

Vaeddas of Ceylon, 584
Valais—
  Vallée de Binn, étude géographique, etc.: L. Desbuissons, 208 †
Vallentin, W., In Brasilien, 212 †
Valley Tracks and Vegetation: G. F. Scott Elliot, 201
Van, Lake of, Kurdistan, 357
Van der Miesen, J. H., Tochten op het eiland Boeroe, 608 †
Van de Wiele, C., Évolution tectonique de la péninsule italienne depuis le Pliocène, 90 †
Vatnajökull glacier, 271, 272
Vautier-Dufour, A., Vue des Alpes avec mer de brouillards prise du Chasseron (Photograph), 104 ‡
Vaux, W. S., Modern Glaciers, 99 †
Velasco, J. L. de, Geografia y descripcion universal de las Indias, 219 †
Venezuela—
  Expedition across Venezuela and Colombia, Journal of: H. Bingham, 191 §
  Maps: Mapa General de Venezuela (Ministro de Guerra y Marina, Caracas), 102 †
  Photographs: H. Bingham, 620 †
Verde river, Bolivia, 165, 525
Vergara y Velasco, F. J., Atlas Completo de Geografia Colombiana, 102 †
Vermilion-on-the-Peace, Northern Canada, 708
Verrazzano's Voyage of 1524, New Light on, 428
Vesuvius—
  Characteristics and Phenomena of present Repose period: F. A. Perret, 73
  Vesuv, eine Vulkanologische Studie für Jedermann: A. Stübel, 207 †
Viala, L. F., Exploration en Haute-Guinée, 609 †
Victoria falls—
  Neighbourhood of Victoria Falls (Rhodesia), Some Notes on: T. Codrington, 211 †
Victoria Nyanza—
  Earth-movements at Lake Victoria: J. I. Craig, 96 †
  Victoria, Lake, to Khartoum: F. A. Dickinson, 437 §, 468 †
Vienna—
  Expansion of Vienna: H. Hassinger, 719
  Maps: Verkehrsplan der k. k. Reichshaupt und Residenzstadt Wien: G. Freytag, 615 †
Vieques, Photographs of: H. Bingham, 620 †
Villatte, M., Surveys in Central Sahara, 197
Virginia—
  Spirit Leveling in Western Virginia, Results of: S. S. Gannett and D. H. Baldwin, 737 †
Vischer, H., Across Sahara from Tripoli to Bornu, 735 †; R.G.S. award to, 592
Volarovich, P., Physical Geography of Apsheron Peninsula, 195
Volcanoes—
  Mechanism of Volcanic Action: H. J. Johnston-Lavis, 473 †
  Schwefels in tätigen Solfataren, Verhalten des: A. Brun, 739 †
Voss, E. L., As chuvas no nordeste da Brasil, 611 †
Vredenburg, E. W., Note on hippurite-bearing limestone in Seistan, 608 †; Report on geology of Sarawan, Jhalawan, etc., 593 §, 607 †

W.

Wagner, P., Lehrbuch der Geologie und Mineralogie für höhere Schulen, 738 †
Wairarapa, Great; a Lost River: H. Hill, 599
Wakimizu, T., Limestone Caves of Nippara in Musashi, 94 †
Walbran, J. T., British Columbia coast names, 1592–1906 .. 469 †, 590 §
Wales—
  Glacial Erosion in North Wales: W. M. Davis, 208 †
  Maps: Official Railway Map of South Wales (Railway Clearing House), 476 †
  River Development in Mid-South Wales: L. Richardson, 464 †
Walker, H. W., Wanderings among South Sea Savages, 191 §, 214 †
Waller, A. R.: *see* Ward, A. W.
Wallis, B., Tour in Liberian Hinterland, 285 *
Wallis, B. C., Practical exercises in geography, 75 §, 100 †; Key to Practical Exercises in Geography, 739 †
Wang-chhu or Tchin-chhu, Bhutan, 32
Ward, A. W., and A. R. Waller, Cambridge History of English Literature, 474 †
Waring, G. A., Geology and Water Resources of Harney Basin Region, Oregon, 470 †
Warker, N., Deutschen Orts- und Gewässernamen der belgischen Provinz Luxemburg, 341 †
Warmbad, German South-West Africa, 497
Warnow—
  Settlements in Warnow district: A. Schulz, 447
Washington—
  Maps: State of Washington (U.S. Dept. of Interior), 743 †
Watherston, A. E. G., obituary, 205
Watson, Sir C., Life of Sir C. Wilson, 443 §
Watts, Hon. F., West Indian Cotton Growing, 348 †
Wauters, A.-J., Afrique Centrale a-t-elle été decouverte au XVI^e siècle? 344 †

Waves—
Wind-waves in Water, Sand, Snow, and Cloud: V. Cornish, 348 †
Weald, Geology of: W. Topley, 219 †
Weather Cycles in Growth of Big Trees: A. E. Douglass, 335 §, 611 †
Weathering and Erosion as Time Measures: F. Leverett, 215 †
Webb, F., Switzerland of the Swiss, 462 †, 582 §
Webb, G. W., Systematic Geography of British Isles, 76 §; Systematic Geography of Europe, 716 §, 730 †
Webernik, G., Kabelnetz der Erde, etc., 349 †
Wedderburn, E. M., Temperature oscillations in lakes and ocean, 613 †; and W. Watson, Observations with a Current Meter in Loch Ness, 463 †
Wegener, A., Drachen- und Fesselballonaufstiege ausgeführt auf der Danmark Expedition 1906–08..612 †
Wegener, K., Samoa-Insel Savaii, 743 †
Weigall, A. E. P., Life and Times of Akhnaton, Pharaoh of Egypt, 734 †; Travels in Upper Egyptian Deserts, 68 §
Weiss, F., Von Bhamo nach Tengyuë, 465 †
Weiss, F. E., Preliminary account of Submerged Vegetation of Lake Windermere, 92 †; and H. Murray, On occurrence . . . of some alien aquatic plants in Reddish Canal, 92 †
Weiss, M., Völkerstämme in Norden Deutsch-Ostafrikas, 734 †
Weldon, L. B., Six Months in Northern Sinai, 345 †
Wellcome Photographic Exposure Record and Diary, 1910..614 †
Wenkchemna glacier, Canadian Rockies, 281
Werth, E., Fjorde, Fjärde und Föhrden, 348 †
West, W. and G. S., British Freshwater Phytoplankton, 463 †
West Indies—
Cotton growing, West Indian: Hon. F. Watts, 348 †
Photographs of: H. Bingham, 620 †
Westmoreland—
Cambridge County Geographies. Westmoreland: J. E. Marr, 181 §
Westropp, T. J., Forests of Counties of Lower Shannon Valley, 91 †
Westwell, J. W., Time-indicating Cylinder, 618 †
Weule, K., Native life in East Africa, 210 †
Wheat—
Development of Wheat Culture in North America: A. P. Brigham, 42 *
Whiffen, T. W., Journey in Amazon Basin, 454
Whitaker, W., remarks on "Some Recent Changes in Course of the Trent," 577; Water Supply of Kent, 208 †
Whitbeck, R. H., Present Trend of Geography in United States, 419 *
White, J. C., Journeys in Bhutan, 18 *; Sikhim and Bhutan, 182 §, 210 †
Wilcox, W. D., Guide-book to Lake Louise Region, 329 §
Wilkes Land—
Proposed American expedition to, 338
Will, G. F., and H. J. Spinden, The Mandans, 470 †
Willcocks, Sir W., letter from, on Mesopotamian Trade and Noah's Flood, 459 Mesopotamia Past, Present, and Future, 1 *; Photographs of Mesopotamia, 104 †
Willenius, J. A., Observaciones Arqueológicas sobre Alfareria Funeraria de la "Poma," 347 †
Williams, H. F., Agro-Geologia do Valle do S. Francisco, 611 †
Williamson, A. P., Text-book of navigation and nautical astronomy, 215 †
Willing, R., Hydrographische Untersuchungen im nördlichen Teile der Ostsee, etc., 180 §
Wilson, Sir C., Life of: Sir C. Watson, 443 §
Wiltshire—
Cambridge County Geographies. Wiltshire: A. G. Bradley, 209 †
Windermere—
Vegetation, Submerged, of Lake Windermere as affecting feeding-ground of fish: F. E. Weiss, 92 †
Winds—
Local winds in south of France: E. de Martonne, 718
Winkler, C., Erforschungen, Erkundungen und Kämpfe in unsern afrikanischen Kolonien, 1907-08..466 †
Winstedt, E. O., Christian Topography of Cosmos Indicopleustes, 474 †
Wisconsin—
Wheat production, 15
Witkamp, H. P. T., Drie buiteneilanden der Banda-Groep, 608 †
Witwatersrand, Intensity Distribution of Rainfall over: H. E. Wood, 468 †
Woeikow, A., Aralsee und sein Gebiet nach den neuesten Forschungen, 94 †. Klima von Snow-Hill, Grahamland, 214 †; Temperatur ostsibirischer Flusse, 465 †
Wolfenden, R. N., Scientific and biological researches in North Atlantic, 216 †, 442 §
Wolff, W., Im malaiischen Urwald und Zinngebirge, 210 †
Wolfgang Lake—
Eigentümliche Temperaturschwankungen von eintägiger Periode im Wolfgangsee: F. M. Exner, 606 †
Wolftoon, Namaqualand, 495

Wood, C. A., British Isles. Practical and Economic Geography, 75 §; Physical and Economic Geography of World, 475 †, 716 §
Wood, H. E., Intensity Distribution of Rainfall over Witwatersrand, 468 †
Wood, J. N. P., Travel and sport in Turkestan, 464 †, 586 §
Woods, Hard, of the Americas — Quebracho, 349 †
Woodward, H. B., and B. Thompson, Water-supply of Bedfordshire, etc., 91 †
Woosnam, R. B., Zoological Results on Ruwenzori Expedition 1905–06 .. 468 †
Words and Places: T. Taylor and A. S. Palmer, 191 §
Workman, F. B., Hispar Glacier. I. Its tributaries and mountains, 105 *; letter from, on Altitude of Mount Huascaran, 458; and W. H. Workman, Peaks and Glaciers of Nun Kun, 210 †, 485 §; Reproductions of photographs taken on expedition of 1906 to Nun Kun Kashmir, 356 †
Workman, W. H., Hispar Glacier. II. Prominent features of its structure, 115; Study of Nieve Penitente in Himalaya, 607 †
World—
Anson's Voyage Round World, 1740–1744: C. G. Cash, 192
General Geography of World: H. E. Evans, 75 §
Map on scale of 1:1,000,000, International Conference, remarks by L. Darwin, 87
New Exploration of World: D. Fairchild, 398 †
Physical and Economic Geography of World: C. A. Wood, 475 †, 716 §
Wright, C. L. H., Subject-Index of London Library, 614 †, 714 §
Wright, M. R., Old and New Peru, 191 §, 213 †
Wright, W. H., Grizzly Bear, 190 §
Würtemberg—
Maps: Kartenskizzen zur Siedlungsgeographie Württembergs: R. Gradmann, 741 †
Morphologie der Swäbisch-Fränkischen Stufenlandschaft: E. Scheu, 77 §, 342 †
Wye valley—
Glacial Features at Aberedw: L. Richardson, 464 †
Wyoming—
Glaciation in, 155
Geology and Mineral Resources of Laramie Basin: N. H. Darton and C. E. Siebenthal, 97 †

X.

Xydis, C., Terrestrial Refraction at Alexandria, 79 §, 99 †

Y.

Yakkhas or Vaeddas of Ceylon, 584
Yakutat Bay region, Phenomena of glacier margins in: B. S. Tarr, 346; Physiography and glacial geology, 610 †
Yang-tse—
Kompolthy auf dem Jang-tse-Kiang: G. v. Halász, 607 †
Yasamal valley, Caucasus, 195
Yengutsa glacier, Himalaya, 107
Yola, boundary between Cross river and, 197
Yorkshire—
Vegetation of some disused Quarries: S. Margerison, 717 §
Yoruba Folk-lore: J. Parkinson, 95 †
Young, G. A., and R. W. Brock, Descriptive Sketch of Geology, etc., of Canada, 610 †
Young, J., and P. H. Aitken, Catalogue of Manuscripts in Library of Hunterian Museum, 475 †, 715 §
Young, R. E., Canada's Fertile Northland, 610 †; Evidence . . . on Forests, Waterways, and Water-powers, 1909 .. 469 †
Younghusband, Sir F., remarks on "Glacier Exploration in Eastern Karakoram," 654
Yucatan—
American Egypt; Record of Travel in Yucatan: C. Arnold and F. J. Frost, 189 §, 212 †
Yukon—
Whitehorse Copper Belt, Yukon Territory: R. G. McConnell, 610 †
Yukon territory, its history and resources, 470 †, 589 §
Yunnan—
Across Yunnan: A. Little, 710 §
Yunnan-fu railway, Completion of, 722
Yuzboi river, Trans-Caspian region, 398

Z.

Zab rivers, Kurdistan, 370, 377
Zacatecas, desert scenes in: J. E. Kirkwood, 611 †
Zacharias, G. K. C., Nivellement over bredere Vandarealer, 89 †
Zaer territory, Morocco, 196
Zambesi—
Congo-Zambesi Watershed, Naturalists' travels on: S. A. Neave, 132 *
Zambesia; general description of valley of Zambesi river: R. C. F. Maugham, 468 †
Zanzibar—
Administration, Financial and General Condition of Zanzibar Protectorate, Report on, 211 †
Zirkel, F., und E. Reinisch, Untersuchung des vor Enderby-Landgedredschten Gesteinmateriales, 214 †

Zon, R., When our Country is Fifty Years Older, 611 †
Zsigmond, B., Ethnographical map of Hungary, 476 †
Zuallardo, G., Il devotissimo viaggio di Gerusalemme, 219 †
Zug, Lake of—
Verunreinigung von Seen durch Einleitung städtischer Abwässer mit spezieller Berücksichtigung des Zugersees. T. Nussbaumer, 343 †
Zurich—
Drumlinlandschaft Zwischen Pfäffiker- und Greifensee (Kanton Zürich): H. W. B. Hellmund, 343 †

INDEX TO MAPS.

EUROPE.

Cambridgeshire rivers, Changes after stoppage of outfall at Wisbech in 1236, 701
Cambridgeshire rivers in Roman Times, 702

ASIA.

Arabia, Northern, Sketch-map showing explorations by A. Musil, 580
Arabia, North-West, showing explorations: D. Carruthers, 356
Hispar Glacier and Tributaries in Karakoram Range: F. B. and W. H. Workman, 224
Karakoram, Eastern, Map of explorations in the: T. G. Longstaff, 744, 434
Karakoram, Peaks of the, 624
Kurdistan, Sketch-map: B. Dickson, 480
Sikkim and Bhutan, illustrating paper by J. C. White, 104
Tigris-Euphrates Delta, illustrating paper by Sir W. Willcocks, 104

AFRICA.

Aboinia River, Nigeria, Sketch-map: J. Burn, 620
Africa, South-West, illustrating paper by H. H. W. Pearson, 620
Kalahari Desert, showing routes taken by A. W. Hodson, 166
Kordafan, Sudan Province of, illustrating paper by W. Lloyd, 356
Liberia, Prismatic Compass Traverse: C. B. Wallis, 356
Libyan Desert, Sand-dunes, Distribution of: H. J. L. Beadnell, 380
Rhodesia, Northern, and Adjacent Territories showing Faunistic Areas: S. A. Neave, 224
Sudan, Anglo-Egyptian, Positions geographically fixed by Sudan Survey Dept., 535

AMERICA.

Bolivia, Explorations and Boundary Surveys: P. H. Fawcett, 620
Uaupés, River, Sketch-map of: Hamilton Rice, 744

AUSTRALASIA

Australia, Map to illustrate paper on the Development of: J. W. Gregory, 744
Australian Commonwealth, Site of Federal Capital, 318–320

POLAR REGIONS.

Diagram showing quick method of determining approximate positions: A. R. Hinks, 302
Greenland, Sketch-map showing Surveys of Danish North-Eastern Greenland Expedition, 1906–8 . . 545

GENERAL.

Mountain Glaciation, Cycle of—
Lofoten Islands, Portion of one of the, 159
Maps and Types of Glaciers, 154, 272–282
Quadrant Mountain, 158
Semicircular Glacial Ampitheatres, 157

ILLUSTRATIONS AND DIAGRAMS.

EUROPE.

Monaco, Oceanographical Museum at, 559

Trent—
Course of Trent, Recent changes in Diagrams, 571-576

ASIA

Arabia, North-Western—
Arab of Teima, 237
Ard-es-Suwan or desert of flint, 232
Beduin of Sherrarat tribe, 236
Beduin warrior, 229
Camel herds at well, 229
Great tent of Sheikh Hathmel of Beni Sakhr, 228
Houses in oasis of Teima, 236
Oryx beatrix, wild cow of the Beduin, 240
Sand-dunes in Western Nafud, 240
Sherrarat Beduin, Small tent belonging to, 228
Table mountains in "Itbaik" region, 233
Wind and sand-worn rock, west of Great Nafud, 236

Bhutan—
Bridge at Angduphodang, 34
Duggye Jong, 20, 21
Farmhouses, Paro valley, 24
Norbu-Gang, Village of, 29
Pashi-cho-Jong, Valley above, 38
Poonakha, 28
Tashi-Cho-Jong, 25
Tongsa Jong, 35; Tongsa Jong, interior, 39

Hispar Glacier—
Border lake near Junction of Jutmaru with Hispar glacier, 119
Camp at 19,100 feet on flank of Biafo-Hispar watershed peak, 109
Debris-covered hillocks, 125
Face of Snow-region directly north of Hispar pass, 118
Glacier table of unusual size on Biafo glacier, 124
Great ice-covered wall forming southern barrier of Hispar glacier, Upper 19·3 kms. of, 119
Hispar-Biafo watershed peak, 112
Mountains forming west wall of Biafo glacier, 112
Mud-covered nieves penitentes, 124
Peaks covered with hanging glaciers above Jutmaru glacier, 108
Telephoto of high peak overhanging junction of Lak glacier with Hispar, 109

Hispar Glacier—*continued*.
White Mamelon covered with nieves penitentes, 108

Karakoram, Eastern—
Aktash glaciers, general view from south, 641
Aktash glacier lying across road, 641
Bilafond glacier, 629
Saltoro pass, Summit of, 629
Saltoro spires, 628
Siachen glacier, Lower, Looking up, 640
Siachen glacier, Upper, Looking down, 635
Teram Kangri across upper Siachen glacier, 634
Teram Kangri from Rgyong La, 640

Kurdistan—
Armenian Revolutionaries, Band of, 360
Batoan nomad Kurds, 371
Chain of Jelu D. and Oramar from south, 360
Chall and mountains of Tiari from south, 370
Enirco-Agha Shekak, High plateau Kurds, 371
Gorge, Typical, in Herki Oramar district, 364
Hartoshi sedentary mountain Kurds, 365
Maidan Sulimania, 364
Oramar village and Sat D. slopes from north, 370
Sat D. from north-west and south-east, 361
Zab in its quieter moods, 365

Mesopotamia—
Babylon, Gate of Istar at, 9
Babylon, Ruins at, 9
Baghdad, South road in, 8
Basra creek, 8
Bull on Gate of Istar at Nebuchadnezzar's palace at Babylon, 12
Island in Euphrates near Anah, 4
Nausherwan's palace, Ctesiphon, 5
Unirrigated Mesopotamia, 5
Water returning from swamp to rivers, 4

AFRICA.

Africa, South-West—
Angola, South, front of Shella range, 495
Angola, South, Inspanning oxen in acacia forest between Gambos and Tchipelongu, 502
Angola, South, "Outspan" beneath a large Ficus, 502
Bushmanland, 488, 489
Damaraland. Lateral ravine of Khan river, 494
Damaraland. "Namib" near Welwitsch, 495
Orange river at Raman's drift, 489, 494
Bornu—
Graveyard at Maiduguri, 451
Overweg's grave at Maduari, 451
Congo-Zambesi watershed—
Copper-mine near Kambove, 141
Dikulwe river, 135
Katwelume falls, Kalungwisi river, 140
Lofu river, 135
Luangwa valley, 134
"Msitu," 141
Native chiefs and wives bringing flour, 134
Pool near Kapopo, 140
Kalahari desert—
Bushmen, Group of, 171
Cart in bed of Nosop river, 171
Kalahari desert—*continued.*
Kakia pan, 169
Kalaharis with melons, 169
Kordofan province—
Bahr-el Homr at Fagoi, Camel corps watering, 253
Baobab tree used for storage of water, 251
El Obeid, Street in, 257
Government buildings at El Obeid, 1900..255
Iron-smelting furnace at Nahud, 265
Nuba types, 259
Nuba village, 263
Nubas, 261
Libyan desert—
Barchan, A typical, 387
Barchan, Section showing internal structure of, 387
Barchans in Kharga oasis, in plan and cross-section, 388
Complex dune on Libyan plateau, 387
Dakhla oasis, Dunes encroaching on cultivated lands in, 387
Kharga oasis, belts of dunes, 386
Kharga oasis, Isolated barchans or crescentic dunes in, 386
Sea of sand between Dakhla and Farafra oasis, 386
Weather chart, April, 1907, Kharga oasis, 384

AMERICA.

Bolivia—
Arequipa, 526
Cobija or Bahia, 519; View from, 519
Corumba, 527
La Paz, 518
Madre de Dios and Bene, Confluence of, 523
Sorata, 518
Tahuamany river at Porvenir, 526
Verde, Rio, Sandstone cañon in, 522
Verde, Upper, 522
Xapury on the Acre, 523
Canada's Farthest North—
Site of A. Mackenzie's last camp on Peace river whence he set out overland for Pacific, 1793..707
Uaupés river—
Broken, rocky character of stream which occurs frequently in middle portion of river, 693
Caruru cataeira, 693
House of a "Racionale," or trader, Carlos Tovar, upper Uaupés, 687
Jurupary cataeira, highest and last on river, showing scoriaceous volcanic character of rock, 687
Maloca of Joaquin, Guainano or Quenano tribe, situated some distance from river, 692
Matapi cataeira, a few hours above Caruru, 692
Puerto Alturo, Rio Guaviare at mouth of Rio Ariare, 686
Transporting cargo to Rio Ariare on Llanos of San Martin, 686
Uaupés river—*continued.*

GENERAL.

His Majesty King Edward VII. . . . Portrait of, *to face* p. 621
Mountain glaciation, Cycle of—
Aletsch- and Dreieckhorns, Position of, 160
Alps, Fretted upland of, 159
Asulkan glacier, View of, 280
Col of overlook looking towards foot of Illecillewaet glacier, 162
Dawson glacier, Multiple cirque of the, 158
Mountain glaciation, Cycle of—*continued.*
Elliptical minor cirques at head of Nicolai valley, Outline plan of, 158
Fish creek, View looking down valley of, 281
Foster glacier, Alaska, Expanded foreefoot of, 268
Glacial cirque, 150
Grooved and fretted uplands, 158
Hanging glacieret, the Triest glacier, 269; Hanging glacierets, Series of, 280

Mountain glaciation, Cycle of—*continued.*
Hanging tributary valley meeting a trunk glacier valley, 269
Multiple secondary cirque on west face of Wannehorn, 157
Matterhorn from Gorner Grat, 162
Piedmont glacier, Type of, 268
Pre-glacial upland invaded by cirques, 156
Pre-glacial upland on Quadrant mountain invaded by cirque known as the Pocket, 156
Ranier, Mount, Irregularly bounded
Mountain glaciation, Cycle of—*continued*
néves upon volcanic cone of, 280
Scalloped tableland within Uinta range, 156
Snowbank lying in depression largely of its own construction, 155
Summer snowbank surrounded by brown border of finely comminuted rock, 155
Types of mountain glaciers, 272–282
Wenkchemna glacier, View of, 281
Yoho glacier, View of, 150.

END OF VOL. XXXV.

PRINTED BY
WILLIAM CLOWES AND SONS, LIMITED,
LONDON AND BECCLES.

THE GEOGRAPHICAL JOURNAL



PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL
EDITED BY THE SECRETARY.

VOL. XXXV.—JANUARY TO JUNE, 1910.

LONDON:
THE ROYAL GEOGRAPHICAL SOCIETY, 1, SAVILE ROW:
EDWARD STANFORD, 12, 13, AND 14, LONG ACRE, W.C.
1910.

PRINTED BY
WILLIAM CLOWES AND SONS, LIMITED,
LONDON AND BECCLES.

ROYAL GEOGRAPHICAL SOCIETY.

PATRON.

VICE-PATRON.

COUNCIL.

(ELECTED MAY 23, 1910)

President—Major LEONARD DARWIN.

Vice-Presidents.

Admiral Sir LEWIS BEAUMONT, K.C.B., K.C.M.G.
Rt. Hon. Lord CURZON OF KEDLESTON, G.C.S.I., G.C.I.E., etc.
Colonel Sir THOMAS HUNGERFORD HOLDICH, K.C.M.G., K.C.I.E., C.B., R.E.
Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., F.S.A.
Rt. Hon. Sir J. WEST RIDGEWAY, G.C.B., G.C.M.G., K.C.S.I., LL.D.
H. YATES THOMPSON, J.P.

Treasurer—EDWARD L. SOMERS COCKS.

Trustees—Right Hon. Lord AVEBURY, D.C.L., F.R.S.; Lord BELHAVEN AND STENTON, D.L.

Honorary Secretaries—Colonel CHAS. F CLOSE, C.M.G., R.E.; Colonel Sir D. A. JOHNSTON, K.C.M.G., C.B., R.E.

Foreign Secretary—Sir JOHN KIRK, G.C.M.G., K.C.B., F.R.S.

Members of Council.

TEMPEST ANDERSON, M.D., F.R.S.
HENRY BALFOUR, M.A., F.Z.S.
Captain H. H. P. DEASY.
Colonel H. W. FEILDEN, C.B.
Admiral A. MOSTYN FIELD, F.R.S.
DOUGLAS W. FRESHFIELD.
Prof. STANLEY GARDINER, F.R.S.
Sir W. E. GARSTIN, G.C.M.G.
Sir DAVID GILL, K.C.B., LL.D., F.R.S.
Rt. Hon. Sir GEORGE D. TAUBMAN GOLDIE, K.C.M.G., F.R.S., D.C.L.
Colonel R. C. HELLARD, C.B., R.E.
Sir HARRY H. JOHNSTON, G.C.M.G., K.C.B.
Rt. Hon. Lord LAMINGTON, G.C.M.G.
H. J. MACKINDER, M.A., M.P.
A. P. MAUDSLAY.
Colonel F. R. MAUNSELL, C.M.G., R.A.
Colonel Sir COLIN C. SCOTT MONCRIEFF, K.C.M.G., K.C.S.I., R.E., LL.D.
Sir ERNEST SHACKLETON, C.V.O.
MARK AUREL STEIN, Ph.D., D.Litt.
Sir EDWARD P. TENNANT, Bart.
Sir FRANK E. YOUNGHUSBAND, K.C.I.E.

Secretary and Editor of Publications—J. SCOTT KELTIE, LL.D.

Librarian—EDWARD HEAWOOD, M.A.

Chief Clerk.
S. J. EVIS

Map Curator.
E. A. REEVES, F.R.A.S.

Bankers—Messrs. COCKS, BIDDULPH and Co., 43, Charing Cross

PRINTED BY
WILLIAM CLOWES AND SONS, LIMITED,
LONDON AND BECCLES.

ROYAL GEOGRAPHICAL SOCIETY.

PATRON.

VICE-PATRON.

COUNCIL.

(ELECTED MAY 23, 1910)

President—Major LEONARD DARWIN.

Vice-Presidents.

Admiral Sir LEWIS BEAUMONT, K.C.B., K.C.M.G.
Rt. Hon. Lord CURZON OF KEDLESTON, G.C.S.I., G.C.I.E., etc.
Colonel Sir THOMAS HUNGERFORD HOLDICH, K.C.M.G., K.C.I.E., C.B., R.E.
Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., F.S.A.
Rt. Hon. Sir J. WEST RIDGEWAY, G.C.B., G.C.M.G., K.C.S.I., LL.D.
H. YATES THOMPSON, J.P.

Treasurer—EDWARD L. SOMERS COCKS.

Trustees—Right Hon. Lord AVEBURY, D.C.L., F.R.S.; Lord BELHAVEN AND STENTON, D.L.

Honorary Secretaries—Colonel CHAS. F. CLOSE, C.M.G., R.E.; Colonel Sir D. A. JOHNSTON, K.C.M.G., C.B., R.E.

Foreign Secretary—Sir JOHN KIRK, G.C.M.G., K.C.B., F.R.S.

Members of Council.

TEMPEST ANDERSON, M.D., F.R.S.
HENRY BALFOUR, M.A., F.Z.S.
Captain H. H. P. DEASY.
Colonel H. W. FEILDEN, C.B.
Admiral A. MOSTYN FIELD, F.R.S.
DOUGLAS W. FRESHFIELD.
Prof. STANLEY GARDINER, F.R.S.
Sir W. E. GARSTIN, G.C.M.G.
Sir DAVID GILL, K.C.B., LL.D., F.R.S.
Rt. Hon. Sir GEORGE D. TAUBMAN GOLDIE, K.C.M.G., F.R.S., D.C.L.
Colonel R. C. HELLARD, C.B., R.E.
Sir HARRY H. JOHNSTON, G.C.M.G., K.C.B.
Rt. Hon. Lord LAMINGTON, G.C.M.G.
H. J. MACKINDER, M.A., M.P.
A. P. MAUDSLAY.
Colonel F. R. MAUNSELL, C.M.G., R.A.
Colonel Sir COLIN C. SCOTT-MONCRIEFF, K.C.M.G., K.C.S.I., R.E., LL.D.
Sir ERNEST SHACKLETON, C.V.O.
MARK AUREL STEIN, Ph.D., D.Litt.
Sir EDWARD P. TENNANT, Bart.
Sir FRANK E. YOUNGHUSBAND, K.C.I.E.

Secretary and Editor of Publications—J. SCOTT KELTIE, LL.D.

Librarian—EDWARD HEAWOOD, M.A.

Map Curator.
E. A. REEVES, F.R.A.S.

Chief Clerk.
S. J. EVIS.

Bankers—Messrs. COCKS, BIDDULPH and Co., 43, Charing Cross.

CONDITIONS OF FELLOWSHIP, &c.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and "£3 as annual subscription for the current year, and thereafter a yearly sub- "scription of £3, due on the 1st January of each year; or he may compound either "at entrance by one payment of £45, or at any subsequent period on the following "scale, provided that there shall be at the time no arrears due by him to the "Society :—

Fellows of 10 years' standing	and under	15	...	£30
„	15	„	„	„	20	...	£24
„	20	„	„	and over		...	£18 15s.

"No Fellow shall be entitled to vote or to enjoy any privilege of the Society while "in arrear. Honorary and Honorary Corresponding Members and Fellows elected "under Chapter III., Paragraph 5, are not required to make any payments."

All Subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Library and Map-room. Each Fellow is also entitled to receive a copy of all the Society's periodical publications. The *Geographical Journal* is forwarded free of expense, to all Fellows whose addresses are known.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had on application at the Society's House, 1, Savile Row, London, W.

CONTENTS.

Authors are alone responsible for their respective statements.

No. 1. *January.*

PAGE

Mesopotamia: Past, Present, and Future. By Sir William Willcocks, K.C.M.G. (with 5 Plates and Map) 1
Journeys in Bhutan. By J. Claude White, C.I.E. (with 10 Plates and Map) 18
The Development of Wheat Culture in North America. By Prof. Albert Percy Brigham 42
Floods in the Great Interior Valley of North America. By Miss Luella Agnes Owen 56
The Volcanic Eruption in Teneriffe. By Dr. John S. Flett 59
Central Asian Archæology. By C. H. H. 61
Dr. Longstaff's Himalayan Expedition, 1909. By Dr. Tom G. Longstaff .. 64
Reviews:—
ASIA 66
AFRICA—The South Central Sahara 66
AMERICA—The Conquest of Mexico 68
AUSTRALASIA AND PACIFIC ISLANDS—Australian Meteorology 70
POLAR REGIONS—Baron Toll's Last Expedition 71
GENERAL—Stanley's Autobiography. Text-Books 72
The Monthly Record 76
Meetings of the Royal Geographical Society, Session 1909–1910 85
Geographical Literature of the Month 88
New Maps 100

MAPS.

Map of the Tigris-Euphrates Delta 104
Map of Sikkim and Bhutan, with Parts of Adjacent Countries 104

No. 2. *February.*

The Hispar Glacier (with 7 Plates and Map)—
I. Its Tributaries and Mountains. By Fanny Bullock Workman, F.R.S.G.S., Officier de l'Instruction Publique de France 105
II. Prominent Features of its Structure. By William Hunter Workman, M.A., M.D., F.R.G.S. 115
A Naturalist's Travels on the Congo-Zambezi Watershed. By S. A. Neave, M.A., B.SC. OXON (with 4 Plates and Map) 132
The Cycle of Mountain Glaciation. By Prof. William Herbert Hobbs, University of Michigan (with 7 Diagrams and 7 Plates) 146
Survey Work on the Bolivia-Brazil Boundary. By Major P. H. Fawcett, R.A., Chief Bolivian Commissioner 163
Notes on Journeys taken in the Kalahari Desert. By Arnold W. Hodson (with Sketch-map and 4 Illustrations) 166
The Norwegian Sea. By Leon W. Collett 172
Reviews:—
EUROPE—Austria-Hungary. The North European Seas. The Baltic .. 179
ASIA—Sikkim a d Bhutan 182

PAGE
AFRICA—African River Vegetation. The Oasis of Air and its Inhabitants 184
AMERICA—Mexico. Mexico and Yucatan 188
AUSTRALASIA AND PACIFIC ISLANDS 191
GENERAL 191
The Monthly Record 193
Obituary—H.M. King Leopold of Belgium. Colonel George Earl Church. Prof. H. H. Giglioli. Lieut.-Colonel A. E. G. Watherston, C.M.G. 202
Meetings of the Royal Geographical Society, Session 1909–1910 206
Geographical Literature of the Month 207
New Maps 220

MAPS.

Sketch-map—Mr. Arnold W. Hodson's Routes in the Kalahari Desert 167
The Hispar Glacier and Tributaries in the Karakoram Range 224
Map of Northern Rhodesia and Adjacent Territories 224

No. 3. *March.*

A Journey in North-Western Arabia. By Douglas Carruthers (with 7 Plates and Map) 225
Notes on Kordofan Province. By Captain Watkins Lloyd, The Cameronians (Scottish Rifles), late Governor of Kordofan (with 8 Illustrations and Map) 249
The Cycle of Mountain Glaciation. By Prof. William Herbert Hobbs, University of Michigan (with 5 Plates and 10 Diagrams) 268
A Tour in the Liberian Hinterland. By Captain Braithwaite Wallis, F.G.S., F.R.G.S., His Majesty's Consul-General at Dakar, lately H.M.'s Consul-General for Liberia (with Map) 285
Project of a Danish Expedition to the Central Eskimo. By Knud Rasmussen 295
Notes on Determination of Position near the Poles. By Arthur R. Hinks, Royal Geographical Society Lecturer in Surveying and Cartography, Cambridge University (with Diagram) 299
The Forests of British East Africa. By M. H. 313
The Annual Meeting of the Geographical Association. Address by the President, Douglas W. Freshfield 314
Geography at Oxford 316
The Capital of the Australian Commonwealth (with 3 Sketch-maps) 318
Reviews :—
EUROPE—Iceland 321
ASIA—Tibet. A Japanese Pilgrim in Tibet 322
AFRICA—The Partition of Africa. South African History 325
AMERICA—Panama and Ecuador. Explorations in Southern Brazil 327
Expedition of H.R.H. the Duke of the Abruzzi to the Karakoram 330
The Monthly Record 332
Meetings of the Royal Geographical Society, Session 1909–1910 339
Geographical Literature of the Month 340
New Maps 350

MAPS.

Sketch-map of North-West Arabia 356
Map of the Sudan Province of Kordofan 356
Prismatic Compass Traverse in Liberia 356

No. 4. *April.*

Journeys in Kurdistan. By Captain Bertram Dickinson (with 6 Plates and Map) 357
The Sand-dunes of the Libyan Desert. By H. J. Llewellyn Beadnell, F.G.S., F.R.G.S., ASSOC. INST. M.M., formerly of the Geological Survey of Egypt (with 4 Plates, Sketch-map, and Diagrams) 379

PAGE

Problems in Exploration—Central Asia. By Ellsworth Huntington 395
The Present Trend of Geography in the United States. By R. H. Whitbeck, University of Wisconsin, Madison 419
Egyptian Irrigation. By Colonel Sir Colin C. Scott Moncrieff, K.C.M.G., K.C.S.I. 425
New Light on Verrazzano's Voyage of 1524 428
A Contribution to Geographical Bibliography. By F. S. A. 430
Reviews :—
Europe—The North Sea. Crete 433
Asia—The Western Himalaya 435
Africa—Abyssinia. Uganda and the Sudan The Heart of Central Africa 436
America—Chile. Chilean Surveys 439
Polar Regions—Antarctic Meteorology 440
Mathematical and Physical Geography—The North Atlantic .. 442
General—Text Book. Sir Charles Wilson 443
The Monthly Record 445
Obituary—Colonel Claude Reignier Conder, R.E., LL.D. 456
Correspondence—The Altitude of Mount Huascaran. By Fanny Bullock Workman. Mesopotamian Trade—Noah's Flood—The Garden of Eden. By Sir William Willcocks, K.C.M.G., and H. Rassam 458
Meetings of the Royal Geographical Society, Session 1909–1910 460
Geographical Literature of the Month 441
New Maps 475

MAPS.

Sketch-map of Approximate Distribution of Sand-dunes of the Libyan Desert 381
Sketch-map of Part of Kurdistan 480

No. 5. *May.*

The Travels of a Botanist in South-West Africa. By H. H. W. Pearson, M.A., SC.D., F.L.S., Professor of Botany in the South African College, Cape Town (with 5 Plates and Map) 481
Explorations in Bolivia. By Major P. H. Fawcett, R.A. (retired) (with 6 Plates and Sketch-map) 513
Progress of Survey in the Anglo-Egyptian Sudan. By Captain Hugh D. Pearson, R.E., Director of Sudan Surveys (with Sketch-map) 532
The Danish North-East Greenland Expedition, 1906–8 : Provisional Results. By Dr. J. Lindhard (with Sketch-map) 541
The Opening of the Oceanographical Museum at Monaco (with Illustration) 558
The Royal Commission on Canals and Waterways 565
Some Recent Changes in the Course of the Trent. By Bernard Smith, M.A., F.G.S. (with 5 Diagrams) 568
Musil's Explorations in Northern Arabia, 1908–9 (with Sketch-map) 579
Reviews :—
Europe—France 582
Asia—Asia Minor. Ceylon. Northern China. East and Central Sumatra 583
Africa—Exploration and Sport in Eastern Equatorial Africa 586
America—The Chile-Argentine Frontier. Southern Chile 588
General—A Bibliography of Ptolemy's Geography 590
The Monthly Record 591
Obituary—Alexander Agassiz. By Sir John Murray 602
Correspondence—Desert Sand-dunes. By Captain David Comyn 605
Meetings of the Royal Geographical Society, Session 1909–1910 605
Geographical Literature of the Month 606
New Maps 614

MAPS.

Anglo-Egyptian Sudan positions geographically fixed by the Sudan Survey Department 535

Page

Sketch-map showing the Surveys of the North-East Greenland Expedition, 1906–8 545
Sketch-map showing Explorations in Northern Arabia 580
Map of South-West Africa 620
Maps to illustrate a paper on Explorations and Boundary Surveys in Bolivia . 620
Sketch-map of the Aboinia River 620

No. 6. *June.*

Death of the King. By Major Leonard Darwin, President R.G.S. (with Portrait) 621
Glacier Exploration in the Eastern Karakoram. By T. G. Longstaff, M.A., M.D. OXON (with Diagrams, 6 Plates, and Map) 622
The Geographical Factors that control the Development of Australia. By Prof. J. W. Gregory, F.R.S. (with Map) 658
The River Uaupés. By Hamilton Rice, B.A., M.D., F.R.G.S. (with 4 Plates and Map) 682
The Cambridgeshire Rivers. By the Ven. W. Cunningham, D.D., Archdeacon of Ely (with 2 Sketch-maps) 700
Canada's Farthest North. By Miss Agnes Deans Cameron (with Illustration) 705
Reviews:—
ASIA—The North-Western Borderlands of India. Western China 708
AFRICA—South Africa 711
GENERAL—Bibliography. Educational Books. Military Geography .. 714
The Monthly Record 717
Obituary—Dr. W. B. Cheadle 727
Correspondence—The True Boundaries of the Continents. By E. Fennell .. 728
Meetings of the Royal Geographical Society, Session 1909–1910 729
Geographical Literature of the Month 729
New Maps 740

MAPS.

Diagram of Peaks of the Karakoram 625
Map of Changes in the Cambridgeshire Rivers after the Stoppage of the Outfall at Wisbech in 1236 701
Map of Cambridgeshire Rivers in Roman Times 702
Map of Explorations in the Eastern Karakoram 744
Map to illustrate Paper on the Development of Australia 744
Map of the River Uaupés 744

HOTEL MÉTROPOLE,

Northumberland Avenue, Trafalgar Square,

LONDON.

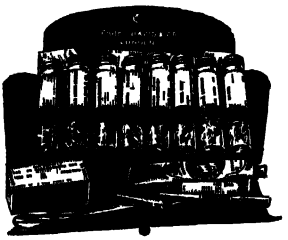


Of world-wide reputation. Conveniently situated, close to Houses of Parliament, Westminster Abbey, Government Offices, Theatres, fashionable quarters, and chief places of interest. Numerous luxuriously furnished suites of apartments. Most magnificent hotel lounge in London.

Telegrams: "Métropole, London."
Telephone 8120 *Gerrard* (20 *lines*)

Gordon Hotels, Ltd

Travellers' Medical Equipments



A convenient size for personal requirements. Illustrations of more complete outfits will be sent on request

For the use of Explorers, Expeditions, et

COMPACT. PORTABLE. RELIABLE.

Furnished with "P., D. & Co. Medicinal Preparations, which a absolutely pure, most convenient for immediate administratio and possess exceptional keeping properties.

PARKE, DAVIS & CO.,

50, BEAK ST, REGENT ST, LONDON, W.

BÂLE. "HOTEL, VICTORIA."

(Quite near Central Railway Station)

First-class Family House of old reputation. Lately quite renewed. Fine large Hall. New Salon and Conversation Rooms. Restaurant. Electric light and central heating in whole house.

NEW BATHS LIFT GOOD CUISINE MODERATE CHARGES

Managed by the Proprietor—PAUL OTTO

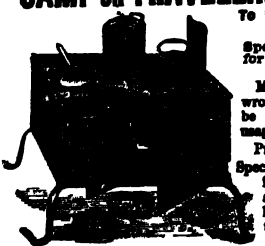
KEATING'S POWDER

KILLS FLEA, MOTH, BEETLE & BUG

Tins 1d 3d 6d & 1/-

THE WROUGHT IRON

CAMP OR TRAVELLING STOVE



To burn wood or an fuel.

Specially designe for Explorers, Mi sionaries, etc

Made of malleab wrought iron. Canno be injured by roug usage. Weight 36 lbs

Price complete, £3

Specialities in Oil Cook ing Stoves for Hom and Export. An kind of stove mad to order

Send for a 100-page Illustrated Catalogue of Stoves for all purposes which will be sent free by mail on application.

W. POOLE & CO. American Stove Stores, 58, Queen Victoria Street, London, E.C.

"YOU CAN INSURE YOUR
Art Treasures, Family Heirlooms,
AGAINST FIRE, BUT
Can You Replace Them?

THOUGH

"Dreadnought" Fireproof Doo

cost no more than Wood Doors and are of ordinary appearance, thickness, and weight they have been able to withstand a temperature of 2000 degrees for 2½ hours. No hinged door of such a size has withstood

HALF AS GREAT AN OFFICIAL FIRE TEST AS T

Supplied to the Government for

The Admiralty, National Gallery, Victoria and Albert Museums, Imperial College of Science, Imperial I
Also Nottingham Post Office Telephone to Edinburgh Law Courts, Royal Insurance Company, Cox's Bank, &c
to Lord Lilford, and many private mansions.

Write for full particulars to

"G.J." DEPT., FIREPROOF DOORS, Ltd.,
46, KING WILLIAM STREET, LONDON, E

BY ROYAL WARRANT TO H.M. THE KING.

POLISHED FLOORS.

RONUK, LTD.

are prepared to Estimate for the Polishing
and the maintenance of all kinds of floors in

MANSIONS,
HOSPITALS, &
INSTITUTIONS

WRITE FOR PAMPHLET

Manufacturers of "RONUK" SANITARY POLISH.

"RONUK," LTD., Head Office & Factory, **PORTSLADE**, near **BRIGHT**
Depôts—**LONDON**: 16, South Molton Street, W.
MANCHESTER: 265, Deansgate.